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a. Radar Station P-20 - Operating Instructions;

b. Radar Station P-20 - Album of Wiring Diagrams, Part II;

c. Description of Alterations Made in Radar Station Type P-20 (Supplement). 50X1-HUM

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INFORMATION REPORT INFORMATION REPORT

SECRET [redacted] 50X1-HUM

RADAR STATION П-20

OPERATING INSTRUCTIONS

SECRET

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Chapter I

PREPARATION OF RADAR FOR COMBAT USE

1. INSTRUCTIONS ON SAFETY MEASURES

While operating the station it is forbidden:

- to connect and disconnect energized cables;
- to come into and out of the receiving and transmitting cabin until the cabin is stopped completely;
- to energize the units of the station with interlocks shorted, with side and top shields of units removed, with units drawn out, with shields of cable boxes and of distributing board removed;
- to look without protective glass at the operating spark discharger for more than 1 min.
- to start the cabin rotating motor when the hatches in the floor are open;
- to stand under the load when the crane is operated;
- to pull backwards the ratchet pawl of the crane winch when it is loaded.

The rotation zone of the vertical-beam reflector (vertical reflector) should be provided with a safety guard.

Each time prior to starting the cabin rotating motor make sure that the men who were previously in and on the cabin are at a safe distance from it.

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The warning signal should sound for not less than 30 sec.

To ensure fire safety it is <u>forbidden:</u>

- to make fire and smoke near trucks and trailers;
- to leave the burning stoves unattended;
- to keep oiled rags and inflammable liquids in unsuitable places.

Only special fire extinguishers available in the station should be used for fire fighting in the equipment.

Sand boxes in the power plants should be always filled with sand and the fire extinguishers should be always ready for use.

2. PREPARATION FOR SETTING UP THE STATION

(1) Site Selection

To set up the radar station, type П-20, (Fig.1) a level site should be selected. To make use of the tactical capabilities of the station, the operating site should not be obstructed by ground features at angles exceeding 0.5°. With the obstruction angles exceeding 0.5° the effective range of the station in scanning the aircraft flying at the altitude of 6000 m. and lower will be considerably reduced.

If no site with the permissible obstruction angles all the way round is available, the station is placed so that these requirements are met with in the most important directions.

If a hill with a suitable site is available on the terrain, it is advisable that the receiving and transmitting cabin be placed on it.

No special preparation of the selected site for the station is required.

(2) Arrangement of Trucks

To reduce the screening effect, it is good practice to line up the trucks heading the least possible direction of observation. Tentative layout of the trucks on the terrain is given in Fig.2.

During combat operation of the radar, four trucks, i.e. a receiving-transmitting (rotating) cabin (truck No.1), a truck with indicators (truck No.2) and two power plants (trucks Nos 4 and 5), should remain on the operating position. The trucks with the plan position indicator repeater (truck No.3), truck-tractor No.8, truck No.6 with two-wheel trailer No.7 for carrying the antenna should be moved off the operating position and camouflaged.

Truck No.1 only should remain in the open on the operating position, while trucks Nos 2, 4 and 5 should be concealed in the accidents of the ground, bushes, etc.

The distance between truck No.1 and truck No.2, truck No.2 and trucks Nos 4 and 5, truck No.1 and trucks Nos 4 and 5 in all cases should not exceed 50 m.

These restrictions are determined by the length of the cables. Due to the same reason the distance between trucks Nos 4 and 5 should not be more than 20 m.

The accuracy of operation of the radar depends on the accuracy of levelling the receiving-transmitting cabin, that is why it is necessary to place it on the most solid ground or to make special arrangements (ramming, pile driving, etc.).

The sloping of the ground for the transmitting-

receiving cabin should not exceed 2 - 3°, otherwise it is necessary to flatten the places for the blocks of the jacks.

All the trucks should be arranged on the selected position immediately upon their arrival except the truck with the trailer and the truck-tractor which are first positioned near the receiving and transmitting cabin and are prepared for unloading the antennas, waveguides and for the assembly of the crane. The station having been set up, the truck with the trailer and the truck-tractor move away from the operating position.

(3) Some Hints on Camouflage and Concealment of Station

The station should be concealed by all possible means. Therefore, in selecting an operating position for the station, it is required that the presence of natural covers (woods, bushes, ravines, precipices, etc.) be taken into account.

In case of absence of the natural covers the station should be camouflaged.

In camouflaging the station it is necessary :

- to dig in all the trucks except the receiving-transmitting (rotating) cabin ensuring due ventilation and access to them and also their quick withdrawal in case of changing the site;
- to camouflage all the trucks with branches of trees, bushes, etc.;
- to cover all the trucks except the antenna assembly with camouflage nets;
- to use camouflage paint.

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3. SET-UP PROCEDURE

(4) Set-Up Procedure for Receiving and Transmitting

Assembly

Set-up procedure for the receiving and transmitting assembly is as follows:

1. Place the receiving and transmitting (rotating) cabin on the selected position.

2. Jack it up.

3. Level it preliminarily by four levels on the carriage.

4. Remove the travelling position braces that connect the cabin with the centre girder and turn the cabin manually.

5. Check the oil level in the reduction unit and add oil if necessary.

6. Remove the antenna system assemblies from the truck-tractor truck and from the trailer.

7. Prepare the truck-tractor and the crane for operation.

8. Install the antenna reflectors (mirrors).

9. Mount the radiators.

10. Mount the waveguides.

11. Level the receiving and transmitting cabins precisely.

12. Install the reflectors according to the adjustment scales and check their installation by the levelling plate.

13. Orient the antenna system by the meridian.

14. Connect the receiver-transmitter tube to the indicator truck and to the power plant by means of cables,

connect the transmitting selsyn and the reflector swinging mechanism to the receiver-transmitter cabin.

15. Set the switches of the reduction unit of the reflector swinging mechanism to MOTOR ON (МОТОР ВКЛЮЧЕН) and to fix them in this position.

16. Install the safety guard of the reflector rotation zone.

17. Inspect the equipment.

18. Set all the controls to their initial positions.

19. Energize the receiver-transmitter equipment from the local control board, check the readings of the instruments and adjust the equipment, if necessary.

The station is cut out and prepared for shipment in the order reverse to the one described above.

Jacking up of the receiver-transmitter cabin and its preliminary levelling are carried out in the following order:

- pull out two side jack rests and fix them with latches in the working position;
- to reduce the pressure on the ground, put wooden blocks that are carried in the body of the truck-tractor under the discs of all four jacks;
- loosen the fixing screws on the jack handwheels and operate the jacks until the wheels of the trailer clear off the ground and the trailer assumes a horizontal position.

The trailer is checked for proper levelling by the levels located near each of the four jacks. Due to the elastic deflection of the trailer centre girder the levels may have no zero readings. Therefore, it is necessary to achieve the same readings of two transverse and two longitudinal levels. Preliminarily the station should be levelled with an accuracy of 1 - 1.5 graduations.

If it appears that with the jacks screwed all the way out some of the wheels fail to separate from the ground so that they may be turned freely, it is necessary to remove some soil from under the wheels or to lower the trailer and to put additional blocks or some soil under the respective discs.

(5) Assembly and Disassembly of Antenna Systems

To assemble and disassemble the antenna systems, the following tools are required.

Wrenches, 22 mm - 5 pieces.
Wrenches, 27 mm - 1 piece.
Wrenches, 19 mm - 2 pieces.
Strops (4 m. long) with hooks - 1 piece.
Strops (3 m.long) with hooks - 2 pieces.
Strops (1 m. long) with hooks - 2 pieces.
Drift pin (30 mm in diameter, 200 mm long) - 4 pieces.
Hammer - 1 piece.
Brass hammer - 4 pieces.

The job is performed by the crew of 7 and one being in charge. Each member of the crew performs certain operations.

All the three-dimensional parts and fastenings should be packed in their due places. It is not allowed to place small fastenings and tools on the ground, use should be made of tarpaulin for this purpose.

In mounting the antenna systems observe the following order of operations:

1. Unloading of the truck-tractor.
2. Installation of the crane.
3. Unloading of the trailer and the truck carrying reflectors.

4. Installation of the vertical-beam reflector on the cabin.

5. Setting the support of the slant-beam reflector in the horizontal position.

6. Assembly of the slant-beam reflector on the ground.

7. Installation of the slant-beam reflector on the cabin.

8. Packing of tools, cases and detachable parts on the trailer and truck.

9. Preparation of the crane for travelling, checking the rope and strops, lubrication of the antenna and crane parts that are not furnished with the anticorrosive coating with solid oil.

(a) Unloading of Truck-Tractor and Installation of Crane

To change over the crane from the travelling (Fig.3) to the operating position, perform the following operations:

1. Remove the tarpaulin from the body of the truck-tractor and from the parts of the crane and unload the cases from the body.

2. Screw off nut 2 of the hinge bolt in the front support, remove pin 3 fastening the jib to the rear support.

3. Remove the lower section of jib 4.

4. Release the end of the upper section of jib 5 resting on the rear support and fastened to knee-plate 6 with a pin.

5. Remove hook suspension 7 from the body and release the rope with the handle of the winch.

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6. Turn off the clamp fastening the upper section of the pillar in the travelling position and set the pillar to the operating position. Fasten both parts of the pillar with a clamping bolt.

7. Fix the lower section of the jib in rest 4 (Fig.4) of the lower section of the pillar.

8. Connect both sections of the jib.

9. Remove brace bar 11 and connect it with guy rope 12.

10. Check the position of the rope on the pulleys.

11. By manipulating the handle of the winch raise the jib up to the crane outreach convenient for fastening brace bar 11 in hinge 7.

12. Set the jib in the operating position with the crane outreach of 3200 mm.

13. Lower the hook down to the level of 0.5 m. above the ground.

14. Check all the connections and points of the locking pins.

(b) Operation of Crane

Prior to operating the crane it is necessary to check the joints for proper connection and to check the lubrication of the friction parts.

In operating the crane it is necessary to observe the following rules:

- do not load the crane above 700 kg;
- turn the crane smoothly especially when loaded;
- take care in lowering the load, lower it smoothly without any jerks;
- do not raise the pawl on the safety handle of the winch while lifting or lowering the load;
- do not allow anybody to be under the load during operation of the crane;

- turn the loaded crane by shifting the jib with the rope fixed in the upper section of the jib;

- while operating the hand winch see to it that the rope is wound on the cylinder correctly and tightly without twisting and looping.

(c) Peculiarities in Operation of Planetary Winch with Safety Handle

H o i s t i n g   P r o c e d u r e

To hoist any load, rotate handle 1 of the winch (Fig.5); in this case threaded hub 2 of the handle is screwed on screw 3 and presses ratchet 4 to the faceplate of screw 5.

Thus, with rotation of the handle, gear shaft 6 is rotated also and through planetary gearing 7 it rotates cylinder 8 of the winch so winding up the rope. While hoisting the load pawl 9 slips over the teeth of the ratchet. The ratchet prevents the cylinder from rotating in the reverse direction.

L o w e r i n g   P r o c e d u r e

To lower the load, rotate the handle in the direction reverse to hoisting; in this case threaded hub 2 of the handle is screwed off screw 3 and releases ratchet 4.

The ratchet locked with pawl 9 slips between the threaded hub of the handle and the faceplate of screw 3. Under the weight of the load cylinder 8 rotates together with gear 6. The slower is rotated the handle, the slower is lowered the load.

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With the cease of rotation of the handle screw 3 is driven into threaded hub 2 and pulls ratchet 4 , and the lowering of the load is stopped.

While lowering the hook without any load pawl 9 of the ratchet may be withdrawn and the handle should be rotated for lowering.

Do not withdraw the pawl when the crane is loaded.

(d) Order of Removal of Antenna System Assemblies from Truck

(Fig.6)

1. Take the tarpaulin cover from the body of the truck.

2. Remove the fasteners of the swinging support, remove three arcs from the body.

3. Use the erection crane to remove the swinging support from the uprights of the body.

4. Remove the braces fastening the middle section of the vertical-beam reflector.

5. Use the erection crane to remove the middle section of the vertical-beam reflector and place it on the erection site.

6. Use the erection crane to remove the fastening support of the middle section of the vertical-beam reflector and place it not far from the truck.

7. Untie and remove the cases with the swinging mechanism, the antenna adjuster and the jack pads.

8. Unscrew the straps fastening the middle section of the vertical-beam reflector.

9. Use the erection crane to remove the middle section of the slant-beam reflector and put it on the blocks on the erection site.

(e) Order of Removal of Antenna System Assemblies from Trailer (Fig. 7)

1. Remove the tarpaulin cover from the trailer, fold it up and place near the trailer.

2. Drop the side gates down: remove the upper strut pipes.

3. Turn off and disengage the braces fastening the intermediate sections of the vertical-beam reflector; manually remove these sections and put them near the middle section or the vertical-beam reflector.

4. Turn off and disengage the braces fastening the intermediate sections of the slant-beam reflector, remove these sections from the trailer and put them near the middle section of the slant-beam reflector.

5. Unfasten the straps fixing the end sections of the vertical-beam reflector; take these sections from the trailer and place them near the middle sections of the vertical-beam reflector.

6. Unfasten the straps fixing the end sections of the slant-beam reflector; remove these sections from the trailer and place them near the middle section of the slant-beam reflector.

When all these parts are prepared, start assembling the reflectors.

Notes: 1. Each number of the crew should know exactly the name and the location places of the assemblies during shipment.

2. Do not use hammer (or any other heavy object) to strike the fasteners during assembly.

(f) Installation of Vertical-Beam Reflector

Fig.8 presents the antenna system set up for operation.

The order of installation of the vertical-beam reflector is as follows:

1. Install the fastening girder of the vertical-beam reflector on the cabin.

2. Mount the central section of the vertical-beam reflector on its fastening girder. For this purpose four numbers of the crew lift the middle section of the reflector and place it into the slots of the girder while the other two numbers of the crew pick it up and match the fastening holes with the handle bars, whereupon pins are inserted into the holes and knocked right home with a hammer.

3. Mount the swinging mechanism of the vertical-beam reflector.

4. Mount the middle and end sections of the reflector. While mounting them observe their marking (the numbers are made on each section of the reflector both on the top and at the bottom).

5. Use the handwheel of the mechanism to set the vertical-beam reflector at zero on the scale of the swinging mechanism.

6. Mount the transmitting selsyn. While mounting it the white markers on the stator and rotor of the transmitter should coincide (the installation place of the transmitting selsyn is shown in Fig.9).

7. Protect the swinging mechanism with a tarpaulin cover.

(g) Installation of Slant-Beam Reflector

1. Set the fastening support of the slant-beam reflector in the horizontal position. The support is set in the horizontal position by two numbers of the crew, one of them stands on the roof of the cabin and pulls the support by the rope attached to it while the other stands on the ground and pushes the support upwards and places it on rest 1 (Fig.10).

2. Assemble the slant-beam reflector on the ground in the following succession :

(a) place the swinging support of the slant-beam reflector on the blocks;

(b) place the central section of the slant-beam reflector on a crosspiece with the working surface facing upwards, lockpin the crosspiece with the central section of the reflector;

(c) connect the middle and end sections of the reflector and lubricate the connections with solid oil;

3. Fix the slant-beam reflector on the support of the cabin, for which purpose:

(a) attach the strops to the reflector in four points and lift it up to the level of the cabin support (Fig.11);

(b) connect the fastening support of the slant-beam reflector to the reflector; for this purpose one of the crew numbers should get onto the roof of the cabin and join the reflector with the support in one point by means of a drift pin, then lockpin the other point, tighten up the nut and having taken the drift pin out of the first point, lock it with a pin; while doing so one of the crew numbers should check the stability of rest 1 (Fig.10);

(c) fit support 2 under the middle section of the slant-beam reflector, check the reflector for proper stability on the rests (Fig.10);

(d) fix the end of the crosspiece of the slant-beam reflector with the cabin support by a piece of rope 3 m. long (Fig.12);

(e) remove the strops from the four points of the reflector and attach a piece of rope 1.5 m. long to the middle part of the reflector (Fig.13);

4. Lift the reflector to the operating position, for which purpose:

(a) hoist the reflector with the crane so that the vertical rope is inclined towards the crane;

(b) remove the free rests, first 2 and then 1 (Fig.10);

(c) when the reflector is in the upper point, it is necessary to lower the support into the slots by smoothly moving the truck-tractor towards the cabin; in this case the two numbers of the crew who are on the roof of the cabin should hold and regulate the position of the reflector and the support;

(d) fix the fastening support of the slant-beam reflector on the roof of the cabin;

(e) hoist the swinging mechanism with the crane, install it in its place and lockpin it;

(f) operate the handwheel to set the swinging mechanism at zero on its scale;

(g) mount the transmitting selsyn of the slant-beam reflector on the axis of the upper point of the support; the check notches on the rotor and stator of the transmitting selsyn should coincide (Fig.14);

(h) protect the swinging mechanism with a cover;

(i) release the reflector from the ropes.

5. Assemble the crane and move the truck-tractor in its place, put the cases, tools and detachable parts in their places.

The antennas are disassembled in the reverse order.

(6) Assembly and Installation of Waveguides and Radiators

The layout of the cases with the waveguides and radiators is shown in Fig.25.

The following instructions should be observed during assembly and installation:

1. Assemble the waveguide channel and the radiators according to the marking made on the parts in red paint.

2. In assembling the brackets of the radiators and the waveguide channel no dirt in the joints and inside the waveguides is tolerable.

3. Put the waveguides and the radiators taken out of the cases on the tarpaulin.

4. The mating parts of the radiator brackets should be cleaned from dirt and should be coated with thick protective lubricant.

The radiators should be assembled in the following order:

(a) take the radiators of the vertical-beam reflector out of case No.2; put them on the tarpaulin with the holder facing downwards;

(b) take the bars for this radiator out of case No.1 and connect them with the holder according to the marking; during assembly it is necessary to pay attention to the matching of the notches; the round coupling nuts

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should be tightened so that the check plates on the bars can be fitted on the screws and locked;

(c) lock all the stops.

Assemble the radiators of the slant-beam reflector in the same order. These radiators are packed in case No.3 while their bars in case No.1.

The radiators are mounted on the reflectors manually by a crew of four. To mount the radiators:

(a) lift and bring the bracket of the radiators up to the level of its attachment to the reflector;

(b) lock first two upper and then two lower hinges.

Note: The brackets of the reflector radiators may be lifted by means of the crane.

The waveguide channel should be assembled in the following succession:

(a) take the woggle joints on the slant and vertical channels out of cases Nos 4 and 8;

(b) connect the waveguides from the flanges of the woggle joints up to the flanges of the antenna switches;

(c) zero the reflectors by the scale strips of the swinging mechanism;

(d) connect the waveguides from the flanges of the radiators up to the flanges of the woggle joints; in this case the waveguide elbows (cases Nos 5, 6, 7 and 8) that are connected to the woggle joints should not shift them from the middle zero position;

(e) the waveguide channel having been assembled, drive out the drain plugs on the lower bends of the waveguides.

In assembling it is necessary to see to it that the waveguides are not soiled, the flanges are supplied with the packing rubber rings, guide pins and gaskets.

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The layout diagram of the waveguide channel is given in Fig.15.

(7) Adjustment of Antenna System

The adjustment of the antenna system includes:

- precise levelling of the receiver-transmitter cabin (of the trailer body);
- setting of the reflectors according to the adjustment scales;
- orientation of the antenna system by the meridian;
- checking of the adjustment scales.

(a) Setting of Trailer Cabin into Horizontal Position

Put wooden blocks under the pads of the trailer jacks of the receiver-transmitter cabin. Put a graduated disc on the cover of the main transmitters unit ФД-01 and put a 30"level on the disc (it is not obligatory that the bubble coincides with the zero notch of the scale but the deflection of the bubble should be within the tolerance of 2' from the vertical position of the rotary joint axis).

Note: If the employed level has another scale graduation, the value of the small divisions may be found from the following Table:

Reading on level scale for 1 m.	Value of small division, min.
1	2
0,07 mm	14"

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1	2
0.08 mm	16"
0.09 mm	18"
0.1 mm	20"
0.11 mm	22"
0.12 mm	24"
0.13 mm	26"
0.14 mm	28"
0.15 mm	30"

When the receiver-transmitter cabin is rotated through 360^{0} by means of the hand drive mechanism, find the deflection of the level bubble mounted on the main transmitter unit from the initial position.

By adjusting the pads of the trailer jacks try to achieve such a position that the bubble of the level deflects from its initial position by not more than ± 0.5 division.

Adjust the levels on the pads of the trailer jacks by the set position of the level on the main transmitter unit. The deflection of the level bubble on the pads of the jacks from the zero position should not exceed +0.5 division of the level scale. The levels are adjusted by the adjusting screws on the level itself.

(b) Setting of Vertical- and Slant-Beam Reflectors in Initial Position

The reflectors are said to be in the initial position when the tilt angle of the vertical-beam reflector

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in the vertical plane constitutes $+4 \pm 0.1^\circ$ and the tilt angle of the slant-beam reflector is $+5 \pm 0.1^\circ$.

The initial angles of the reflectors should correspond to the zero readings of the tilt scales on the panels of the indicator truck.

The central tube of the adjuster (Fig.16) is inserted into the central hole of the reflector. By matching the holes in the lever and bracket, the adjuster is preliminary set at 4° for the vertical-beam reflector and at 5° for the slant-beam reflector according to the marking of the device. The ball of the device retainer should enter the slot of the special plate of the reflector with a small clearance.

Fix the retainer in this position.

Put a 30" level on the table of the device; the level should be located in parallel to the notches made on the table.

The bubble of the level should be set against zero of the scale (the permissible deviation is ± 1.5 divisions of the level scale).

The reflectors are zeroed manually by the reduction unit of the swinging mechanism.

With the reflector being in the initial position, the slide scale of the swinging mechanism should read 0 on the tilt angle scale. In this case the notches of the transmitting selsyns of the slant and vertical-beam reflectors which are made on the rotating parts and stators of the selsyns should coincide.

<u>Note</u>: New readings on the scales of the swinging mechanism should be matched with the readings on the scales of the receiving selsyns in truck No.2 so that the zero readings on the scales of the swinging mechanisms correspond to the zero readings on the scales of the receiving selsyns.

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(e) Levelling of Longitudinal Axis of Vertical-Beam Reflector

The longitudinal axis of the vertical-beam reflector is levelled by turning the fastening support of the reflector around its axle to which it is secured.

For this purpose it is necessary to loosen two lock screws near the axle (the left point of attachment of the beam) and three lock screws near the end section of the beam beside the scale (the right point of attachment of the beam), and to use two adjusting screws (one on the top and the other on the bottom) to lower or lift the right end of the beam so that the pointer indicates the value engraved on the name-plate beside the scale.

Then it is necessary to lock all the loosened bolts (Figs 17 and 18).

(f) Setting of Longitudinal Axis of Slant-Beam Reflector at Tilt Angle of 45°

The longitudinal axis of the slant-beam reflector is set at an angle of 45° by turning the vertical rod of the fastening support of the slant-beam reflector with the help of a round nut. This rod is located in the left-hand point of attachment of the support to the body (when looking from the rear side of the slant-beam reflector). The position of the scale index engraved on the name-plate near the scale corresponds to the correct angle of tilt.

(g) Setting of Lead Angle of Vertical Reflector Relative to Slant Reflector

(Turn Angle of 10°)

The lead angle of the vertical reflector is set

relative to the slant reflector by turning the round nut of the horizontal rod (Fig.19) located in the left-hand point of attachment of the vertical-beam reflector (the left-hand end of the fastening beam of this reflector). The adjustment is carried out by means of a round tap wrench according to the position of the indicator relative to the scale made on the end of the rod. The lead angle value of the vertical-beam reflector is engraved relative to the slant-beam reflector on the name-plate beside the scale.

Notes: 1. On some of the stations the levelling of the longitudinal axis of the vertical-beam reflector, the setting of a lead angle of the vertical-beam reflector and the setting of the slant-beam reflector longitudinal axis at an angle of 45° should be performed not by the zero marks on the respective scales, but by setting other values that are given in the table of the setting data of the Service Log.

2. The accuracy of setting the reflectors by the adjustment scale should be checked after the station is set up for operation for the first time or after a long-term storage.

After the repair of the supports, reflector fastenings, etc. when the cabin is damaged as well as when the error appears regularly in measuring an altitude, the data of the adjustment scales of the reflectors should be checked in the following way:

(a) Setting of Longitudinal Axis of Vertical-Beam Reflector by Horizon

Prior to setting the theodolite for precise levelling

of the vertical-beam reflector it is necessary first to level the reflector by means of the adjuster.

The adjuster is placed at 4°. The reflector is set in the initial position.

On the table of the adjuster is placed a level that should be perpendicular to the notch made on the table. (This setting of the level is performed only during levelling of the reflector). The bubble of the level should be set against zero.

Then, find the place of installation for the theodolite by means of a steel rope (cord), 6 - 8 m. long and 2 - 3 mm in diameter with a threaded tip M3x5.

The tip of the rope is screwed into the hole of the right-hand reference point. The other end of the rope is employed to draw (in whatever possible way) line "a-a" on the bearing surface. Then, the threaded tip is screwed into the hole of the left-hand reference point and with the same radius line "b-b" is drawn on the bearing surface.

The intersection point of lines "a-a" and "b-b" is the exact place of installation of the theodolite by the plumb. The plumb is set accurate within 3 mm (Fig.20).

After the theodolite is set horizontally, the crosshairs of the theodolite tube are matched with the centre of one of the reference points. The readings of the theodolite vertical scale are put down. Match the crosshairs of the theodolite tube with the centre of the other reference point and put down the readings on the vertical scale of the theodolite.

Find the difference in readings of the theodolite vertical scale. The difference characterizes inaccurate levelling of the reflector.

Variations in the distance from the side reference points up to the installation place of the theodolite on

the bearing surface result in a change of the permissible angular deflection between the reference points (difference in the readings between the first and second measurements).

Distance from side reference points up to installation place of theodolite on bearing surface in mm	Permissible angular deflection (difference in readings between first and second measurements)
5100	7'10"
5700	6'30"
6400	5'30"
7000	5'
8000	5'
8300	4'
8700	3'45"

If the difference in the readings exceeds the angular value given in the table, it is necessary to level the reflector more precisely.

The reflector is lowered and raised by adjusting screws 1 on the horizontal beam (Fig.20). After the reflector is mounted tighten up the bolts clamping the beam to the bearing surfaces of the cabin. Thereupon, make a repeated check of the reflector installation.

The adjusted position of the reflector is fixed on the scale fastened to the beam by the index on the bracket. The reading of the scale is entered into the Service Log of the station.

(b) Setting of Longitudinal Axis of Slant-Beam Reflector at Angle of 45° Relative to Horizon

Prior to mounting the slant-beam reflector on the cabin, measure the distance between sights E and L with a measuring tape and record it (Fig.21). See to it that the tape is not slack while measuring.

Find the tentative layout of the crosshairs projection of sights E and L on the bearing surface.

Install the theodolite at a distance of 10 - 30 m. from the reflector and level it precisely. Lay the sighting tube of the theodolite at the crosshairs of sight E. Then turn the optical axis of the theodolite in the vertical plane downwards, sight and mark (using any method) line "c-c" in the area of the crosshairs projection of lower sight E of the bearing surface.

Then, sight the crosshairs of the upper sight, turn the optical axis of the theodolite in the vertical plane downwards and take line "b-b" in the zone of the upper sight crosshairs projection on the bearing surface.

Thereupon, take the theodolite to another position relative to the reflector also at a distance of 10 - 30 m. from it and level it precisely.

Sight the crosshairs of lower sight E, turn the optical axis of the theodolite in the vertical plane downwards on the bearing surface and mark line "d-d" that crosses line "c-c" made during the first sighting. Then, take the theodolite to the third position and level it precisely. First, sight the crosshairs of upper sight L and then turn the optical axis of the theodolite in the vertical plane downwards and mark line "a-a" that crosses line "b-b" on the bearing surface.

Crossing point B of lines "c-c" and "d-d" is the

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crosshairs projection of lower sight E on the bearing surface. Crossing point A of lines "a-a" and "b-b" is the crosshairs projection of upper sight L on the bearing surface.

After that, measure the distance between points A and B with a measuring tape.

The distance between these points divided by the distance between the crosshairs of both sights E and L of the slant reflector produces the cosine of unknown angle φ ,i.e. Cos $\varphi = \frac{AB}{FL}$

The accuracy of setting of angle $\varphi = 45^\circ \pm 5'$. It is necessary to find such a relation that Cos φ = 0.70711. At different values of EL value AB is determined from the Table below.

Value EL,mm	Value of projection AB at		
	45°	$45^\circ 5'$	$44^\circ 55'$
7560	5345.7	5337.9	5353.5
7561	5346.5	5338.6	5354.2
7562	5347.2	5339.4	5355.0
7563	5347.9	5340.0	5355.6
7564	5348.6	5340.8	5356.4
7565	5349.4	5341.5	5357.1
7566	5350.1	5342.2	5357.9
7567	5350.8	5342.8	5358.5
7568	5351.5	5343.5	5359.3
7569	5352.1	5344.2	5360.0
7570	5352.9	5345.0	5360.3
7571	5353.5	5345.6	5361.3

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Value H, m	Value of projection AB at		
	45°	45°5'	44°55'
7572	5354.2	5346.4	5362.0
7573	5355.0	5347.1	5362.8
7574	5355.8	5347.9	5363.5
7575	5356.4	5348.5	5364.1
7576	5357.1	5349.3	5364.9
7577	5357.9	5350.0	5365.6
7578	5358.5	5350.6	5366.3
7579	5359.3	5351.3	5367.0
7580	5360.0	5352.0	5367.8
7581	5360.9	5352.8	5368.5
7582	5361.3	5353.4	5369.1
7583	5352.0	5354.1	5369.9
7584	5362.8	5354.9	5370.6
7585	5363.5	5355.6	5371.3
7586	5364.1	5356.3	5371.9
7587	5364.9	5357.0	5372.6
7588	5365.6	5357.8	5373.4
7589	5366.3	5358.5	5374.1
7590	5366.9	5359.1	5374.6
7591	5367.7	5359.8	5375.3
7592	5368.4	5360.5	5376.0
7593	5369.1	5361.2	5376.7
7594	5369.8	5361.9	5377.4

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Value EL,mm	Value of projection AB at		
	45^{0}	$45^{0}5'$	$44^{0}55'$
7595	5370.5	5362.6	5378.1
7596	5371.2	5363.3	5378.8
7597	5371.9	5364.0	5379.5
7598	5372.6	5364.7	5380.2
7599	5373.3	5365.4	5380.9
7600	5374.0	5366.1	5381.6
7601	5374.7	5366.8	5382.3
7602	5375.4	5367.9	5383.0
7603	5376.1	5368.2	5383.7
7604	5376.8	5368.9	5384.4
7605	5377.5	5369.6	5385.1
7606	5378.2	5370.3	5385.8
7607	5379.9	5371.0	5386.5
7608	5380.6	5371.7	5387.2

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ection AB at	
'	44°55'
5 .	5378.1
3	5378.8
	5379.5
	5380.2
	5380.9
	5381.6
	5382.3
	5383.0
	5383.7
	5384.4
	5385.1
	5385.8
	5386.5
	5387.2

By turning the adjusting screw located on the left bracket of the support, and by lifting or lowering point E try to make the distance of section AB keep within the limits given in the Table.

It is good practice to check the accuracy of determining the projection of sight E on the bearing surface from the fourth position of the theodolite by marking line "n-n" on the bearing surface. The projection line of sight L is found in a similar way. In this case all three lines "c-c", "d-d" and "n-n" should cross in one point.

The adjusted position of the slant-beam reflector is fixed on the scale of the adjusting screw and is entered into the certificate of the truck.

It is not necessary that the adjusting screw should read zero but it should be mounted so that there is an adjustment margin in any direction (the sight of the adjusting screw should not deflect from the zero division of the scale by more than $\pm 20'$).

(c) <u>Adjustment Relative to Angle between Reflectors</u> Place the theodolite at a distance of 10 - 30 m. from the vertical-beam reflector and level it precisely.

Lay the sight tube of the theodolite at the crosshairs of sight N (Fig.22) and by turning the tube of the theodolite in the vertical plane downwards mark line "z-z" in the zone of the sight crosshairs projection on the bearing surface.

Then, take the theodolite to another position relative to the reflector and mark similarly line "e-e" that crosses the line made during the first sighting. The crossing point of the lines on the bearing surface is the crosshairs projection of the vertical reflector sight on the bearing surface in point N.

Set the theodolite in point B according to its plumb and level it precisely (the location of point B on the ...aring surface was determined in Item 4b). In this case

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displacement of the tripod [redacted] is permissible. From this position direct the sighting tube of the theodolite at the crosshairs projection of the slant reflector upper sight in point A whose location was determined earlier (Item 4b) with the setting of the turning scale at zero. Then, turn the tube of the theodolite until the crosshairs of the sighting tube coincide with the crosshairs projection of sight N of the vertical reflector on the bearing surface and determine turning angle α by the scale of the theodoli[te]. The latter is set in point N by its plumb and is levelled precisely.

Lay the sighting tube of the theodolite at the crosshairs of sight N of the vertical reflector, whereupon, determine turn angle β by laying the sighting tube of the theodolite at point B.

In this case the turning scale of the theodolite is set at 0°. The unknown angle of turn of the reflector

$$\varphi = 180^\circ - \alpha - \beta = 10^\circ \pm 4'.$$

If the actual angle φ does not correspond to the angle of $10^\circ \pm 4'$, turn the reflector through the required additional angle by means of adjusting screw K.

A new check of actual angle φ after the vertical-beam reflector is turned with the adjusting screw is carried out in the same way as described above.

If necessary, it is allowed to install a shortened attachment shackle of the vertical-beam reflector and a gasket under the bracket with its subsequent soldering to the unit. The adjusted position of the vertical-beam reflector is fixed by the scale of the adjusting screw and is recorded in the certificate of the truck.

It is not necessary that the sight of adjusting screw K should indicate zero, but it should not deflect from the zero position by more than $\pm 12'$.

(f) Orientation of Antenna Relative to Meridian

Orient the antenna relative to the meridian by means of theodolite, type TT-50, with the compass following the procedure listed below:

1. Place the theodolite at a distance of not less than 15 - 20 m. from the station, level it up and orient by the compass, i.e. lay the sighting tube by the north line.

2. Lower the plumbs passing through the centres of the diopters of the vertical-beam reflector.

3. By turning the receiver-transmitter cabin and the sighting tube of the theodolite make the plumb line or the diopter coincide with the vertical sighting line of the theodolite tube (Fig.23).

4. Take the angle between the northern direction (by the pointer of the compass) and the direction towards the diopters (angle α).

While sighting from the left diopter through the right one[x] find the angle for mounting on the main transmitter unit by the following formula: $\beta = 360^\circ - (\alpha - 90^\circ)$, and while sighting from the right diopter through the left one by the formula: $\beta = 360^\circ - (90 - \alpha)$.

If angle β is greater than 360°, then subtract 360° from angle β and consider the obtained angle as angle β

5. If the local magnetic declination is equal to zero, set the scales at the obtained angle β on the main transmitter unit with the help of the differential. In case of presence of the magnetic declination it is necessary to

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x) The right-hand diopter is the diopter that is located to the right of the observer who faces the operating surface of the reflector.

make an allowance for it. If the declination is eastern, it is necessary to add the declination angle to the transmitter angle and if it is western, the declination angle should be subtracted from the transmitter angle. In separate cases it is more convenient to orient the antenna by the magnetic meridian. In this case no allowance for declination is introduced.

Further, while checking the orientation of the station it is convenient to make use of a single ground feature that is visible on the plan position indicator.

For this purpose, upon accomplishment of orientation with the use of the theodolite and after matching zeroes on the main transmitter unit and in the indicator truck (Para.4) energize the station, single out an individual ground feature on the plan position indicator and find its azimuth on the scale of the indicator. Henceforth, see to it that the ground feature remains in the former position.

Otherwise, it is necessary to match the position of the ground feature by means of the differential on the main transmitter unit.

(8) Set-Up Procedure for Indicator Truck

After the indicator trucks are positioned on the site, a place for the cable reels is selected. While unloading the trucks, the cable reels should be divided into two groups.

The first group includes the reels with the cables that interconnect indicator trucks Nos 2 and 3. They incorporate cables: 1118, 1108, 1109, 1110,1111, 1112 and 1113.

The second group includes the reels with the cables that connect the indicator truck with the receiver-transmitter cabin (truck No.1). They incorporate cables: 1114, 1116,

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[illegible], 1103, 1104, 1105, 1115, [illegible], [illegible], [illegible], [illegible] and [illegible].

In connecting the cables use should be made of the cable connection diagram between the trucks and of the markings on the connectors.

Note: During shipment and storage all the cable connectors and their mating parts on the boxes should be protected by covers in order to prevent them from getting dirty or the insulation from being damaged.

Both ends of each connection cable are symmetrical and are terminated in the same connectors. That is why it is not important which end of the cable is connected to the given box.

Each cable is marked with a four-figure number inscribed on the connector, the cable should be coupled with the connector that bears the same marking.

All the cables are reeled for shipment. Cables 1101, 1102, 1103, 1104, 1105, 1106, 1107 are kept in the indicator truck, cables [illegible], 1108, 1109, 1110, 1111, 1112, 1113, [illegible], 1401, [illegible] are kept in the truck with the plan position indicator repeater and cables [illegible], [illegible], [illegible] are in the trucks for power plants.

To make the cable uncoiling and coiling operations more convenient and quick, use should be made of one of the methods given below.

FIRST METHOD. 1. Take the case with poles out of the truck-trailer and, if the weather is wet, drive them into the ground at a distance of 1.5 - 2 m. one from another.

In case of dry weather or in winter the poles are driven in after the cables are uncoiled.

2. Open the covers of the respective cable boxes.

3. Take the reeled cable out of the packing stuff, and put it on the collapsible brackets on the body of the truck.

4. Take the cable by its ends (never take it by its connectors), start uncoiling and move towards the trucks to be connected until the cable touches the ground. Lift the cable in the touch-down point and repeat the operation until the cable is uncoiled completely.

In uncoiling the cable support the cable and hold back the reel by the handle.

5. Put the uncoiled cable onto the metallic poles.

6. If the distance between the trucks is less than 50 m., do not coil up the excessive length of the cable but loop it on the poles so that it cannot be tangled.

7. Bring the ends of the cables to the cable boxes of the trucks to be connected, open the plugs (covers) of the cable and instrument parts of the connectors, couple the instrument and cable parts of the connectors and couple the plugs of the instrument and cable parts of the connectors.

8. Put the empty reel into the antenna carrying truck.

SECOND METHOD. In uncoiling the cables, the reels of the first group are placed between the indicator trucks. The second group of the reels is placed between the indicator truck and the receiver-transmitter cabin. The cable reel to be uncoiled is put onto board vertically and a metal rod is inserted into the hole of the reel.

Two numbers of the crew draw the cable in both directions (to the trucks) up to the cable boxes.

If the distance between the trucks is less than the cable length, then do not uncoil the reel completely and leave it on the board. Do the same with the other reels.

To coil up the cable on the reels:

(a) fold the cable in two;

(b) put the bending place into the slit of the reel;

(c) put the reel onto the bracket and start coiling the cable on it;

(d) fasten the connectors to the reel with straps.

In uncoiling the cables, it is necessary to take into account that:

1. The cables connecting the swinging mechanism and the transmitting selsyn with the receiver-transmitter cabin are kept in the packing together with the swinging mechanisms (case No.2). Wrong connection of the cables (if the cable runs from the connector of the transmitting selsyn directly to the swinging mechanism and vice versa) may cause burning out of the transformer in the control units of the swinging mechanisms of the slant and vertical-beam reflectors. That is why it is necessary to follow the cabling diagram between the trucks and the connector markings on the cable and cabin.

2. Cable 1118 for connecting the plan position indicator repeater is wound on three reels: 1118-1, 1118-2 and 1118-3; 100 m. on each of them. If the distance between the indicator trucks does not exceed 100 m. use should be made of one reel only, but if the distance between these trucks exceeds 100 m. this cable should be composed of two or three reels according to the distance between the trucks.

(9) Set-Up Procedure for Power Plants

After the power plants are installed on the operating site, they should be prepared for operation.

The preparation of the plant for operation includes laying the cables from the plant to separate consumers, starting and warming up the engine.

The procedure for connecting the power plant with the consumers is as follows:

1. Take the cables wound on the reels out of trucks Nos 4 and 5 and unreel them towards consumers.

2. While attaching the connectors to the cable boxes observe their marking.

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The designation of the cable consists of: a figure that indicates the number of the cable in the diagram, the first letter that stands for the name of the truck that carries the cable, the second letter that shows the name of the truck to which the cable is to be connected. For instance, cable 3-ЭИ denotes cable 3 carried in the power plant and connecting the power plant with the indicator truck.

Out of two cables 6-ЭЭ designed for connecting the two power plants, it is necessary to unwind the one that is kept in the stand-by power plant. This cable is connected to the instrument parts of cable connectors 1211 of the stand-by and 1216 of the main power plants. The same cable that is kept in the truck for the main power plant will be employed as a jumper when connected to the A.C. power mains. For this purpose, insert the cable into the instrument parts of connectors 1430 and 1216 of the main power plant.

3. Connect three wires from the power mains to thumb-screw terminals 1431.

4. Attach the telephone cable, 50 m. long, leading to telephone switchboard 4-ЭИ to the main power plant and connect another telephone cable 5-ЭЭ (20 m. long) that couples the telephones of both power plants in parallel across the same terminals 1143 between the main and stand-by power plants.

5. In case the commercial mains voltage is applied to the power plant check it for the correct phase sequence. For this purpose, switch on the power plant fan and determine the direction of its rotation. If it rotates fanning the air out of the truck body, the phase sequence is correct; in case it rotates fanning the air into the truck body, transpose any two of the three wires across terminals 1431.

After the cables are laid down, start, warm up and, if necessary, adjust the engine. In warming, starting, adjusting and servicing the engine follow the "Diesel Engine, Type ЯАЗ-204Г, Description and Operating Instructions".

It should be borne in mind that it takes about 20 min. to warm up the engine at the ambient temperature of from 0 to +50°C up to the moment when the load can be connected. At higher temperatures of the ambient air the warming procedure is shorter.

In bitter frost it takes a considerable time to prepare the engine for starting, to start and to warm up the engine. Therefore, it is good practice to start preparing the engine for operation immediately upon its arrival at the position.

(10) Arrangement of Auxiliary Trucks

While setting up the station, the truck-tractor and the truck with the antenna carrying trailer are located near the receiver-transmitter cabin. After the station is set up, the truck-tractor and the truck with the trailer are moved to the site selected beforehand and are protected with tarpaulin covers. Free cable reels, cases for waveguides and other equipment unnecessary for combat operation of the radar are placed into the body of the truck-tractor and the truck with the trailer.

4. PREPARATION OF RADAR FOR TRAVELLING

Preparation of the radar for travelling consists in dismantling and packing the antenna system and the waveguide

[redacted]

channel, in winding the cables on the reels, in packing the reels and in checking the equipment for proper fastening.

Preparation of the truck running gears is carried out according to the general service rules.

Disassembly of the antennas, waveguides and packing of the cables are carried out in the order reverse to the one described in Section 3, Chapter 1.

(a) Dismantling of Crane

To prepare the crane for travelling (Fig.24):

(a) set the jib along the truck-tractor;

(b) winch the hook to the extreme upward position and pull the jib up until its rod is loose;

(c) take pin 3 out of the pulley bracket;

(d) lower the jib to the ground and loosen the rope;

(e) take out locking pin 2, remove brace bar 4 and secure it to jib lower section 5; insert the pin into the hole of the pulley bracket;

(f) disengage the jib in its lower section 6; remove the pin from the pivoted hinge and remove the lower section of the jib;

(g) put upper end 8 of the jib on rear support 9 and secure the other end of the jib to knee plate 10;

(h) put hook 1 and the rope into the body of the truck-tractor;

(i) put lower section 5 of the jib on rear support 9 and the upper section on front support 11 and make it fast;

(j) release the hinge assembly of the upper section and secure it in support 9.

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(b) Arrangement of Waveguides and Cases in Truck-Tractor

Pack the waveguides and radiators into the cases according to the markings on the cases, waveguides and radiators.

Arrange the cases in the truck-tractor according to the inscriptions made on the truck-tractor and case numbering.

The cases are placed manually. After placing they are tied up with a rope as is shown in Fig.25 and the body of the truck-tractor is covered with tarpaulin.

5. TRANSPORT OF RADAR

(11) Preparation of Receiver-Transmitter Cabin for Transport

After the receiver-transmitter cabin trailer is prepared for transport and its both reflectors are dismantled, their fastening supports should be secured for travel.

Then, the trailer should be inspected and checked for:

1. Condition of wheels and tyres and their position.
2. Reliability of fastening the outrigger legs.
3. Position of jacks (they should be brought to the extreme upper position).
4. Condition of brakes.
5. Proper lubrication of the running gears.
6. Reliability of fastening the wedges.
7. Fastening of the cabin with the hinged bracket and braces.

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8. Condition of the trailer drawbar.

9. Closing of the doors and hatches of the cabin.

10. Proper fastening of the units in the cabinets, reliable attachment of cable connectors and proper closing of the doors of the cabinets. Do not leave any equipment in the cabin not secured.

All the measuring instruments should be removed from the cabin and packed into the cases for spare parts, tools and accessories.

(12) Preparation of Indicator Trucks for Transport

To prepare the indicator trucks for transport:

1. Put the breastplates into the pockets and fix the telephone boards.
2. Check all the units for proper fastening in the cabinets.
3. Check the nuts on the filament terminals for proper tightening.
4. Lower the desks near the cabinets and fix them.
5. Check the lamps for proper mounting and fixing.
6. Check the cable connectors for proper coupling and see that the cables are secured in the locks.
7. Close the doors of the cabinets and lock them up.
8. Close the covers of the fans.
9. Close the connectors of the cable box using covers.
10. Close the cable box from outside and inside the truck body, close the recesses for the indicators and the doors of the plug blocks.
11. Close the telephone switchboard, telephone set, type TAM-43, and fix the receiver of the telephone exchange.

12. Check the spare parts, tools and accessories cases for proper packing of the equipment (it should be packed tight).

13. Check the reels with the cables for reliable fastening.

14. Remove the stove pipe and secure it in the stove compartment.

15. Close the cases under the truck body.

16. Secure the seats.

17. Remove the ladders.

(13) Preparation of Two-Wheel Trailer

Before attempting to tow the two-wheel trailer:

1. Check the load for reliable fastening.

2. Check the hubs of the wheels, the spring pins and the springs for proper lubrication.

3. Check the trailer for proper coupling with the truck.

4. Remove the supports of the truck body, check them for reliable fastening by shaking them by hand.

(14) Coupling and Towing of Trailer by Truck-Tractor

Prior to bringing the truck-tractor to the trailer with the receiver-transmitter cabin the driver should check the trailer coupling. The trail plate should be raised up to the level of the coupling assembly. Turn the truck-tractor so that it can be stopped at a distance of not less than 3 m. from the trailer.

One man should stand in front of the truck tractor while the man in charge of the coupling operation should stand near the coupling assembly and give signals when

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the truck-tractor approaches the trailer. Drive up the truck-tractor easily and couple it with the trailer. Then, after making sure that the coupling is done properly, pass the brake rope of the trailer to the body or cabin of the truck-tractor, check its signalling system and check the condition of the brakes of the truck-tractor and trailer.

Prior to making a move the personnel should take their positions in the truck-tractor. In this case one or two men are detailed to brake the trailer and one to keep his eye on the coupling assembly and the trailer in travel.

Start off easily without jerks using the first gear. After the truck-tractor is accelerated, change over to the next gear.

(15) Driving Out and Travelling in Column

Prior to driving out the personnel should once more check the condition of all the travelling equipment (serviceability of the brakes, coupling assemblies, availability of the towing ropes, chains, track grousers, entrenching tools as well as tools for trucks, and presence of fire extinguishers). All the drivers should have driving licences and other route documents.

When travelling in column along an even road, the distance between the trucks should be not less than 20 m.

Special care should be taken by the driver of the truck-tractor. He should always keep it in mind that the manoeuvreability and cross-country capacity of the truck-tractor are restricted by the trailer.

To avoid an excessive wear of the main friction clutch during travel, do not keep the leg on the clutch pedals.

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The weight of the trucks in the travelling position is as follows:

truck No.1 - 11.3 t.;
truck No.2 - 9 t.;
truck No.3 - 8.6 t.;
truck No.4 - 9.75 t.;
truck No.5 - 9.75 t.;
truck No.6 - 6.7 t.;
truck No.7 - 2.7 t.;
truck No.8 - 9.3 t.

Turns

While towing the trailer with the receiver-transmitter cabin do not make any sharp turns. The turning radius for the truck-tractor with the trailer should be not less than 12 - 15 m. When it is necessary to turn the trailer at a smaller radius, the driver should change to a lower gear (the first or the second one).

The coupler or the brakeman should see to it that during the turn the track does not reach the drawbar nearer than 0.25 m. If this occurs, he gives a signal to the driver who should drive the truck-tractor straight forward and only then may he continue to turn.

To avoid overturning, do not turn such corners that would cause the front wheels of the trailer to start sliding in the direction of the turn without rotation.

Climbing Hills

Climbing hills by the truck-tractor with a trailer calls for special care and skill on the part of the driver and the crew. A gradient exceeding 13° is overcome separately, if possible, i.e. first, the truck-tractor gets over it and then the trailer is pulled up with a rope.

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Before attempting to climb a hill, it is necessary to examine the route so as to make sure that there are no obstacles on the ground ahead. Besides, it is necessary to find out the condition of the road and the nature of the soil.

Before to start climbing, the driver once more checks the condition of the brakes and the operation of the valve mechanisms of the foot brake.

It is advisable to climb a hill in one gear (the first or the second one). It is not allowed to disengage the master clutch and change over the gear when negotiating a h

In case of an emergency stop during the climb it is necessary to give a signal to the brakeman as to the braking of the cabin and to apply brakes on the truck-tractor (to pull the control levers as far as they will go and to lock them). Put blocks under the tracks and the wheels of the trailer when they stop.

To resume the movement, give the RELEASE BRAKES signal to the brakeman, engage the first gear and start moving. First, release one steering clutch and when the truck-tractor starts moving release the second clutch and gradually increase the fuel feed.

To climb hills and to negotiate slopes in glazed frost, the tracks should be fitted with grousers and the braking should be increased by additional means.

Negotiating Slopes

To negotiate slopes is more difficult than to climb hills.

Having approached a steep slope the driver and the brakeman examine it with a view to determine its steepness, the condition of the road (presence of turns, pot holes, ditches, etc.) and the nature of the soil.

Do not leave the truck-tractor on the slope with the engine running since the truck-tractor may slide down the slope causing damage.

Having examined the road the driver gives the ATTENTION, APPLY BRAKES signal to the brakeman and starts towing the trailer to the slope. The first gear should be used on down gradients.

While moving down the hills do not disengage the master clutch since the truck-tractor may gather full speed and become uncontrolled.

The brakeman should so apply brakes that the trailer does not run against the truck-tractor. The coupling assembly should be always tense.

Avoid turns and abrupt braking on down gradients.

It should be borne in mind that to turn to the left on steep slopes, it is necessary to engage the right steering clutch while to turn to the right, it is necessary to engage the left steering clutch.

Negotiating Ditches and Banks

Before attempting to negotiate ditches and banks by the truck-tractor with a trailer the driver should thoroughly examine the obstacle.

A ditch or trench with steep walls may be overcome only in case its width does not exceed half the diameter of the trailer wheel. In this case the cabin should not touch the ground. If necessary, the walls of such a ditch should be cut down.

When approaching an obstacle, the driver should change to a lower gear and drive the truck-tractor smoothly. When the wheels of the trailer enter the ditch, it is

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necessary to increase the engine speed gradually until it gets over the obstacle.

To avoid overturning of the trailer, the truck-tractor should approach a ditch at a right angle.

While negotiating a bank, after crossing its top apply brakes to the truck-tractor and the trailer and drive down slowly. Do not change over the gear and do not turn the truck-tractor while negotiating a bank. Full application of brakes to the trailer wheels increases the possibility of its skidding.

Fording

Prior to fording it is necessary to estimate its approaches, the condition of the river bed, the depth and the width of the ford and the possibility of getting out of it.

Mark the ford and the deepest place with poles. Then, prepare the approach roads on the near and far banks. If the banks are steep or precipitous, they should be cut down to form a gradient of 10 - 15°.

The ford should be crossed in the first gear maintaining the engine at high r.p.m. Do not change gears while fording.

Driving in Soft Soil

Driving of the truck-tractor with the trailer in sand, through passable swamps and snow is allowed in low gear only. If the trucks ahead are sinking down, the truck-tractor should not follow their track.

If the truck-tractor starts sinking down, uncouple the trailer at once and drive the truck-tractor to a firm soil. Then, pull the trailer across this place by means of a towing rope.

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Small areas with sticky or loose soils may be traversed with the aid of logs, brush woods or any other available material that can be put under the tracks and wheels.

Driving on Ice

To drive the truck-tractor on ice, the tracks should be fitted with grousers. Before attempting to drive on ice, determine the thickness of the ice. To determine the thickness of the ice at the crossing site, make several holes spaced at 20 - 25 m. and measure the transparent portion of the ice.

To ensure that the truck-tractor and the trailer will pass across the ice, it should be not less than 1 m. thick. If the ice is thinner (but not less than 60 cm.), lay timber planking on the ice and tow the trailer separately by means of a long rope.

In getting over the ice crossing, the traffic should move in low gear smoothly and without any turns, if possible. No stops and gear changing are allowed. If the ice is covered with a thick layer of snow, clean the road without exposing the ice.

Driving Across Bridges

While crossing a bridge the truck-tractor and the trailer should drive in a low gear without any jerks and gear changing. When traffic moves across a bridge, no congestion is allowed in front of or behind the bridge. For this purpose the officer i/c the column works out beforehand a traffic schedule for the column to cross the bridge.

If the bridge load carrying capacity is insufficient, the truck-tractor and the trailer cross it separately by

means of a towing rope. If the decking appears to be weak, it should be reinforced.

Driving Across Railway Crossings

While crossing the railways tracks, it is necessary to put boards or other available material under the tracks of the truck-tractor.

Driving Truck-Tractor Off Trailer

After placing the trailer in position, it is necessary to uncouple it from the truck-tractor. For this purpose the coupler stands beside the coupling assembly and the assistant driver in front of the truck-tractor to communicate the signals to the driver.

The driver shifts in the reverse gear and moves the truck-tractor slightly backwards with a view to loosen the coupling assembly. After the truck-tractor is uncoupled, put the coupling assembly in its place (shackle, rope, etc.) and check the condition of the coupling assembly.

While moving off, drive the first 3 - 5 m. straight forward without making turns.

Note: Detailed description of the truck-tractor and its operation rules are given in brief temporary instructions supplied with each truck-tractor.

Driving Truck with Trailer for Carrying Antenna System Assemblies

While driving the truck with the two-wheel trailer, the following rules should be observed:

1. The speed of the truck with the trailer should not exceed: for asphalt roads - 50 km/hr, for country roads - 20 km/hr, for bad country roads - 10 km/hr.

2. Usual precautions for negotiating obstacles (slowing down the speed, making a detour, avoiding side jerks on the front wheels while overcoming hummocks and pot holes) are also obligatory for driving the truck with a trailer.

3. No backward movement is allowed for the truck with a trailer.

4. Due to the peculiarities of the load it is necessary that starting off, gathering the momentum, braking, and stopping should be done smoothly without any jerks.

5. Uncoupling the trailer from the truck-tractor first drop the front and rear supports of the trailer and lock them in order to prevent the trailer from overturning.

6. SWITCHING ON AND OFF THE RECEIVER--TRANSMITTER EQUIPMENT

(16) Preparation for Switching On the Equipment

Before attempting to switch on the receiver-transmitter equipment it should be examined as follows:

1. In the high-frequency units check the condition of the magnetrons and see that the contacts are good in their filament circuits: tighten up the connectors in the receivers, antenna switches, ignition voltage rectifiers and the receiver supply units.

2. In the local control cabinet check to see that the cables are properly connected in the distribution box, and tighten up the screws in the contact strips, if necessary.

3. Check the receivers, their supply units and the ignition voltage rectifiers for proper installation of the valves.

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4. Check the operation of the turning gear of the receiver-transmitter cabin (from the manual drive).

Prior to starting the rotation of the cabin manually, remove the braces from the cabin, remove the rear stop and having turned the cabin 1/4 of a revolution raise this stop upwards (nearer to the centre of the trailer) and lock it in this position up to the end of the operation time. Inobservance of these precautions may result in damage. Turn the cabin around without applying considerable effort (3 - 4 kg to the handle), without jerks and abrupt stops.

After it is found out that the rotation of the cabin is even all the way round, check the operation of the lever-type switch of the reduction unit. For this purpose open the hatch and check the levers for proper engaging at the moment of switching. Then check the reduction unit for presence of lubricant and add lubricant, if necessary.

5. In summer and during continuous operation of the cabin in winter the ventilation hatches should be kept open while the door should be closed.

6. Before attempting to supply voltage from the power plant all the switches of the control cabinet in the receiver-transmitter cabin and on the central control board in the indicator truck should be turned to OFF in order to avoid inadvertent remote switching during inspection of the equipment.

The following positions of the controls should be considered as initial ones:

(a) on the central control board ПУ-02:

- VOLTMETER CHANGE-OVER SWITCH (ПЕРЕКЛЮЧАТЕЛЬ ВОЛЬТМЕТРА) - any of the three;
- FAN (ВЕНТИЛЯТОР) - OFF (ВЫКЛ.);
- LIGHTING (ОСВЕЩЕНИЕ) - OFF;
- RECEIVER-TRANSMITTER EQUIPMENT SWITCH (ВЫКЛЮЧАТЕЛЬ ПРИЕМО-ПЕРЕД. АПП.) - OFF;
- CABIN ROTATION (ВРАЩЕНИЕ КАБИНЫ) - OFF;

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(b) all the control knobs of the circuit breakers on the keyer at ON (ВКЛ.);

(c) the switches of the radio frequency units on all their cabinets at ON;

(d) on the panel of the local control cabinet ШУ-02:

- RECEIVER-TRANSMITTER EQUIPMENT (ВКЛ.ПР.ПЕРЕД.АПП.) CHANGE-OVER SWITCH - at OFF;
- 1500 c.p.s. GENERATOR INDEPENDENT SWITCHING (НЕЗАВИС.ВКЛ.ГЕНЕРАТОРА 1500 гц) change-over switch at INDEPENDENT SWITCHING (НЕЗАВИС.ВКЛ.);
- MAGNETRON MODE (РЕЖИМ МАГНЕТР.) change-over switch - at NORMAL SWITCHING (НОРМ.ВКЛЮЧ.);
- VOLTMETER CHANGE-OVER SWITCH - at any of the first three positions;
- CABIN HEATING (ОБОГРЕВ.КАБИНЫ) switch - at OFF;
- CABIN VENTILATION (ВЕНТИЛ.КАБИНЫ) SWITCH - at OFF;
- main charge-over switch - at OFF;
- first field rheostat of type ВПЛ-12 set - at the extreme left positions.

7. When this check is made, cut in the knife-switches of the power plant that energize the receiver-transmitter equipment.

8. With the supply cut in on the indicator and receiver-transmitter trucks check the zero divisions of the swinging mechanism scales for proper matching with the zero divisions of the selsyn scales on the panels. In case of misalignment remove the covers from the monitoring selsyns and release the screws fastening the stators of the selsyns. By turning the stators of the selsyns by hand, try to match the readings on the scales.

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(17) Local and Remote Switching of Receiver-

- Transmitter Equipment

Local Switching

During combat operation the receiver-transmitter equipment is switched on remotely from the indicator truck while in case of any check use should be made of the local switching.

To determine whether the elements of the automatic system operate properly, check them in all positions of the main switch following the Description.

In damp weather or after a long period of set-up warm up the equipment and remove moisture from the waveguide channel by turning the RECEIVER-TRANSMITTER EQUIPMENT change-over switch to the BLOWING OUT (ПРОДУВ) position and the WAVEGUIDE HEATING (ПРОГРЕВ ВОЛНОВ.) switch to ON.

The trial rotation of the cabin should be carried out from the local control board. The cabin may be rotated only when the receiver-transmitter equipment change-over switch is turned to BLOWING OUT, READY (ПРОДУВ, ПРЕДВ.ВКЛЮЧЕНИЕ) or ON (ПОЛН.ВКЛЮЧ.) and the cabin rotation stop with the frame are raised up.

WARNING: Prior to rotating the cabin make sure that the personnel stand clear of it and see that the two front braces of the cabin are released.

Remote Switching

The remote switching of the cabin is effected from the central control board ЩУ-02 located in the indicator truck.

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1. Set all the controls on the panel of the local control cabinet ШУ-02 to their initial positions (the change-over switch of the 1500 c.p.s. generator should be in the INDEPENDENT SWITCHING position).

2. Turn the switch of the receiver-transmitter equipment which is located on the local control board to the REMOTE CONTROL (ДИСТ.УПР.) position.

3. Turn the switches on all the receivers to REMOTE GAIN CONTROL and ASC.

4. Set the RECEIVER-TRANSMITTER EQUIPMENT switch located on the central control board in the indicator truck to the ON position. In this case the receiver-transmitter equipment will be automatically switched on in a certain succession in 5 min. The succession of the equipment switching will be indicated by the lamps on the central control board.

5. Set the rotation speed of the receiver-transmitter cabin at 3 r.p.m. by turning the CABIN ROTATION (ВРАЩ. КАБИНЫ) change-over switch mounted on the central board. This switch as well as the switch of the transmitting cabin rotation may be put on only by pressing the warning signal button. After one or two turns of the cabin set the CABIN ROTATION switch to the 6 r.p.m. position.

The whole equipment is cut out in the reverse order.

To switch on the fan of the body of the receiver-transmitter equipment turn on the switch on the local control board. This fan should be connected depending on the temperature of the air.

The stove for heating up the body of the receiver transmitter equipment is cut in from the local control board; it should be connected at low temperatures prior to energizing the receiver-transmitter equipment.

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(18) Standard Readings and Permissible Deviations of Readings of Measuring Instruments

The readings of the instruments during different modes of operation of the station should be as follows:

In the mode of preliminary switching:

- the excitation voltage of the motor-generator set, type ВПЛ-12, as read off on the instrument of the local control cabinet should be 50 - 90 V;
- the voltage of 350 c.p.s. as read off on the instrument of the local control cabinet should be 150 - 190 V;
- the currents of the magnetrons as read off on the instruments in all radio frequency units and on the central control board should be 15 - 20 mA.

In the mode of complete switching:

- the excitation voltage of the set, type ВПЛ-12, as read off on the instrument of the local control cabinet should be 90 - 130 V;
- the voltage of 350 c.p.s. as read off on the instrument of the local control cabinet should be 185 - 225 V;
- the currents of the magnetrons in all the radio frequency units should be 24 ± 2 mA.

DO NOT INCREASE THE ANODE CURRENTS OF THE MAGNETRONS ABOVE 28 mA.

(19) General Information on the Order of Operation

Every day during daily inspection after the receiver-transmitter equipment has been completely on, check the operation of the following units of the radar:

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- receivers;
- antenna switches;
- keyer;
- radio-frequency units;
- ignition voltage rectifiers.

The operation of the receivers is checked simultaneously with the antenna switches by means of the microammeter (100μA) and the radar tester, type PT-10, for measuring sensitivity.

The following is to be checked: the currents of the crystal detectors, the operation of the AFC, the presence of noise at the mixer unit input.

The order of the check is as follows:

1. Turn the ASC-MSC (АРЧ-РРЧ) switch on the receiver to ASC (АРЧ).

2. Insert the microammeter (100μA) in the CURRENT OF AFC CRYSTAL (ТОК КРИСТАЛЛА АПЧ) jack of the receiver and check the current of the AFC mixer crystal. It should be within 60 - 80μA. Its value is set by adjusting the coupling with the aid of the screw located on the AFC mixer. After the coupling is adjusted, lock the screw with a nut. At the same time the operation of the AFC circuit is checked. With the AFC circuit functioning properly the pointer of the microammeter should be motionless.

If the readings of the microammeter are unstable, the adjustment of the klystron heterodyne should be made or the defect in the AFC circuit should be eliminated.

3. Insert the 100μA microammeter in the SIGNAL CRYSTAL CURRENT (ТОК КРИСТАЛЛА СИГНАЛА) jack and check the current of the signal crystal mixer. It should be within the range of 25 - 30μA. If the readings are not within this range, adjust the coupling by turning the

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screw located on the signal mixer of the antenna switch. When the adjustment is over, lock up the screw.

Note: Prior to checking the current of the signal crystal mixer, find out whether the shutter of the signal mixer is open.

4. Check the antenna switch spark gaps for excitation.

The excitation of the rectangular and side circular spark gaps is determined by the glow observed through special holes. The excitation of the circular spark gap with ignition is checked by the ignition current on the ignition voltage rectifiers. This check is at the same time the check of the ignition rectifier.

To check: open the lower left cover on the door of the high-frequency unit and insert the 300 μA microammeter in the IGNITION CURRENT (ТОК ПОДЖИГА) jack of the ignition unit. The instrument should read 90 - 150 μA.

All the other receivers are checked in a similar way.

The receivers having been checked, leave the AFC-MFC switches of the receivers in the AFC position and the LGC-RGC (МРУ-ДРУ) switches in the RGC (ДРУ) position.

5. Place the mixer СБ-50 switch in the respective positions and check noise at the mixer input of all the receivers.

During combat operation of the radar the receiver-transmitter equipment is under supervision of the senior officer or the operator stationed at the control cabinet in the indicator truck.

Operable condition of the receiver-transmitter equipment is evidenced by normal stable readings of the milliammeters on the central control board, normal images on the indicator screens and by indicating lamps. In case of any variations in readings or considerable oscillations

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of the pointers of any milliammeter and also in case of presence of inner interference on the indicator screens stop the cabin rotation, find out the cause of the trouble, remedy it, whereupon proceed with the operation.

During the first several hours of the radar operation gradual reduction of the anode currents of the magnetrons is to be observed as a result of warming up the set, type ВПЛ-12. In this case stop the cabin and use excitation rheostat of the set to bring the duties of the magnetrons to normal ones.

The operation of the AFC in the receivers should be under supervision of the operator of the СБ-50 mixer unit who should alternately examine the noise of all the receivers on the screen of the monitoring indicator of the СБ-50 unit. The malfunction of the AFC is evidenced by the rhythmic change in the level of noise in the defective receiver.

The swinging of the reflectors is controlled by the altitude indicator cabinet operator (the slant-beam reflector) and by the control cabinet operator (the vertical-beam reflector) by the command of the officer on duty.

7. SWITCHING ON AND OFF THE INDICATOR EQUIPMENT

(20) Preparation for Switching On the Indicator Equipment

After transportation and prior to switching give a thorough inspection to all the units and cables of the indicator equipment. This should be inspected from the rear side of the cabinets.

During inspection the units should be checked for:

- presence and condition of valves and pipes;
- condition of cable connectors;
- reliability of contacts in filament clamps;
- reliability of contacts on the distribution board;
- mechanical damage.

In all other cases only general inspection is carried out before switching.

(21) Preliminary Switching On, Testing and Switching Off the Indicator Equipment

After the radar is set up for operation the indicator equipment may be tested and adjusted by means of the antenna rotation simulator located in the indicator truck.

The indicator equipment should be switched on by consecutively depressing two buttons on each of the supply units. With the depression of the white button the motor-fan of the supply unit and the filament of the valves are put on.

30 - 40 sec. after the filament circuits are cut in (after a click is heard), the anode voltage is cut in by depressing the blue button.

To cut out the supply units, depress the red button.

The modes of operation of the supply units are checked by means of a voltmeter inserted in the monitoring jacks. The voltmeter is employed to check the basic voltages +300 V, -150 V and 6.3 V.

To switch on and check the operation of the units in the indicator equipment:

1. Cut in the supply unit of the range marker cabinet, wait for 1 - 2 min. until normal operating condition in the range marker unit ДА-01 is set; thereupon, by consecutively turning the switches on the front panel of

the unit make sure that the images on the screen of the monitoring tube with the switches being in any position correspond to those given in Table 1. If the images on the screen do not correspond to the tabular ones, the unit should be adjusted either partially or completely (Para. 39).

If all the images on the screen of the monitoring oscillograph are unstable and do not correspond to the tabular ones, the unit should be adjusted completely. In all other cases the unit is adjusted only for those positions of the switch in which the images on the screen of the oscillograph do not correspond to those given in Table 1.

2. Energize the rotation simulator. To do this, turn the OPERATION - SIMULATION (РАБОТА - ИМИТАЦИЯ) switch to SIMULATION, thereby causing the red lamps to burn. In 30 - 40 sec. the ROTATION (ВРАЩЕНИЕ) switch is turned on, thereby causing the neon lamp to burn.

3. Place the СЛ-262 ARMATURE (ЯКОРЬ СЛ-262) switch in the servo system selsyn repeater ХА-01 (the second compartment from the bottom in the range marker cabinet) to ON. In 8 - 10 sec. the rotating elements of the repeater unit should be pulled in step with the antenna rotation simulator. The coarse and fine scales should rotate smoothly counter-clockwise without any jerks. In this case the neon lamp in the recess of the repeater unit should go out and should not burn again.

If the repeater unit fails to be pulled in step (the neon lamp sometimes flashes brightly or does not go out at all while the scales rotate with jerks), the servo system should be adjusted either partially or completely (Para. 41).

4. Cut in the supply unit of the plan position indicator cabinet.

Turn the [illegible] ARMATURE switch to ON thus enabling the deflecting system to rotate.

Turn off the MARKER SCALE and at the sweep scale of 4[illegible] km. set such brightness of the sweep line that is faint on the screen. Turn on the range markers and by turning the AZIMUTH MARKER AMPLIFIER ([illegible]), RANGE MARKER AMPLIFIER ([illegible]), AZIMUTH MARKER OUTPUT ([illegible]), RANGE MARKER OUTPUT ([illegible]) adjusting screws set normal brightness of the 5- and 30-degree azimuth markers and 10-, 50-, and 100-km. range markers convenient for the operator.

If the plan position indicator [illegible] does not operate properly, it should be adjusted either completely or partially (Para.4[illegible]).

If this fails to restore normal operation (i.e. when the azimuth markers are doubled, confused, or separate markers are missing), then the adjustment of the azimuth marker unit [illegible] is imperative. The adjustment should be carried out according to the present instructions (Para.4[illegible]).

5. Turn on the supply unit of the azimuth and range indicator cabinet [illegible], set the normal brightness of the sweep and range markers as indicated in Fig.1[illegible].

If the indicator does not function properly, it should be subjected to a partial or complete adjustment (Para.4[illegible]).

6. Turn on the supply unit of the altitude indicator cabinet [illegible]. set the normal brightness of the sweep and all markers as indicated in Fig.[illegible].

If the indicator does not operate properly, it should be subjected to a partial or complete adjustment (Para.44).

The adjusting screw of the ALTITUDE ANGLE MARKER ([illegible]) (in the height indicator compartment) should be turned to ANGLE MARKERS ([illegible]).

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If in this case the angle markers are not obtained or they are abnormal, the angle marker unit ЗА-01 should be adjusted according to Para. 45.

7. Check the operation of the plan position indicator in the plan position indicator repeater truck and adjust it, if necessary (Para.42).

The mixer is checked up together with the receivers. The complete adjustment procedure for the mixer is described in Para.46.

Upon completion of these steps the preliminary check of the indicator equipment is finished.

Energize all the units of the indicator equipment with the exception of the antenna rotation simulator ИВ-01. Zero the receiver-transmitter cabin by the fine and coarse scales of the main transmitter unit ФД-01 and check all the indicators for accurate zeroing, then switch on the receiver-transmitter cabin rotation and check the azimuth markers for accurate setting.

If necessary, adjust the zero marks and the 30-degree azimuth markers precisely (Para.42).

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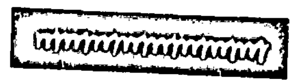
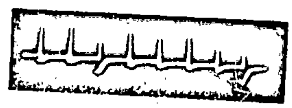
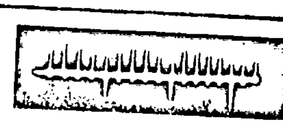
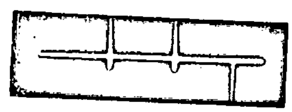
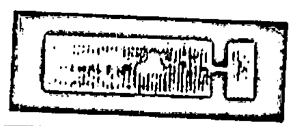
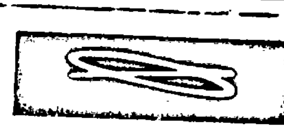
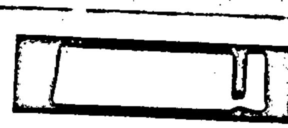
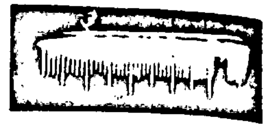
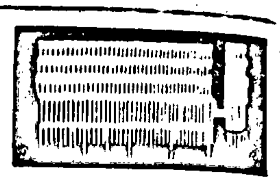
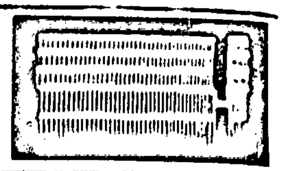
Table 1

Display on Screen of Oscillograph Tube with Range Marker Unit Switches in Different Positions

Position of switch			Display on screen of oscillograph tube
Checking	Starting	Horizontal sweep	
1	2	3	4
CALIBRATOR DIVISION I	MARKER FROM CALIBRATOR	FAST	
CALIBRATOR DIVISION II	MARKER FROM CALIBRATOR	FAST	
CALIBRATOR DIVISION III	MARKER FROM CALIBRATOR	SLOW	
CALIBRATOR DIVISION IV	MARKER FROM CALIBRATOR	SLOW	
AMPLITUDE OF SHOCK-EXCITED CIRCUIT	MARKER FROM CALIBRATOR	SLOW	
AMPLITUDE OF SHOCK-EXCITED CIRCUIT	MARKER FROM CALIBRATOR	SINE	
FREQUENCY OF SHOCK-EXCITED CIRCUIT	MARKER FROM CALIBRATOR	SINE	
FREQUENCY OF SHOCK-EXCITED CIRCUIT	MARKER FROM CALIBRATOR	SLOW	
MARKER SCALE	MARKER FROM CALIBRATOR	SINE	

1	2	3	4
MARKER SCALE	MARKER FROM CALIBRATOR	SLOW	
MARKERS	MARKER FROM CALIBRATOR	SLOW	
MARKERS	INDIC. FROM CALIBRATOR	SLOW	

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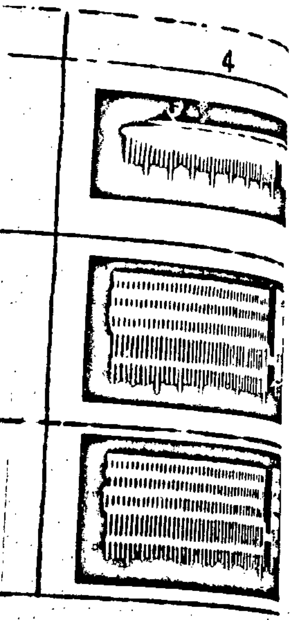

Chapter II

COMBAT OPERATION OF RADAR

1. PERFORMANCE CHARACTERISTICS

The radar type П-20, provides for:

1. Continuous all-round scanning of space. The rotation speed of the antenna system may be chosen either 3 or 6 r.p.m.

At the speed of 3 r.p.m.:

(a) the detecting power is increased;

(b) the detecting range is increased;

(c) the wear of the turning mechanism is decreased;

(d) the possibility of finding the coordinates is reduced.

This speed of rotation should be always employed when there is no need in finding the coordinates very often. In guiding the high-speed aircraft use should be made of the rotation speed of 6 r.p.m.

2. Determining the three target coordinates: slant range, azimuth and height without interrupting the all-round scanning.

3. Detecting a medium bomber or a similar aircraft by its reflecting surface when the aircraft is flying from and toward the station at the ranges of:

Flight altitude, m.	Detecting range, km.
500	50
1000	70
2000	100
4000	150
6000	165
9000	190
11,000	190

4. Determining the range within which the altitude of the aircraft may be found when the aircraft is flying toward and from the station.

Flight altitude, m.	Maximum range, km.
500	50
1000	70
2000	100
4000	120
6000	135
9000	150
11,000	165

The data given in Items 3 and 4 are true for the constant tilt angles of the vertical and slant beam antennas equal to 0°.

When the swinging (tilting) of the antenna is employed, the aircraft detecting range may be increased especially with respect to the vertical beam. For instance, at the altitude of 6000 m. the detecting range (tracking when the aircraft is flying from the station) may amount to 230 - 250 km. instead of 165 km.

However, it should be borne in mind that when the antenna is swinging:

(a) the reliability of scanning is reduced since it is difficult to set the appropriate angles of tilt precisely;

(b) the ceiling of the detecting zone at the medium and especially at the maximum ranges is decreased;

(c) the accuracy of height finding is also reduced.

Therefore, it is advisable that swinging be resorted to only in those cases when the radar is not supposed to scan the aircraft at different ranges and at all altitudes within the zone alloted to this radar. Besides, the operator or the officer on duty employing the swinging of the antenna should study well the radar coverage diagrams and be prudent in performing the swinging.

The swinging of the vertical-beam antenna should be resorted to in those cases when the radar is supposed to detect targets at altitudes not over 9000 m. The lower are the altitudes of the detected targets, the oftener the swinging should be resorted to.

In long-range tracking (when the target is flying from the station) after all the possibilities of the first channel are used up, tracking may be continued through the second channel if the target is within the range of direct visibility.

In all cases when the swinging of the antennas is resorted to, the obstruction angles should be accounted for. If these are over 1^{o}, the swinging should be resorted to only at the maximum altitudes of the order of 11,000 m., with the obstruction angles equalling 0.5^{o} at the altitudes of higher than 4000 m., with the obstruction angles less than 0.25^{o} at all altitudes.

It is not advisable to resort to swinging the slant-beam antenna within a wide range for purposes of increasing the distance within which the altitude may be determined first of all due to its low efficiency and then because additional errors in height finding may appear.

5. Elevation coverage:

- for the detection zone - 0 - 22^{o};

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- for the height finding zone - 0 - 20°.

6. Upper height limit:

- for the detecting zone - about 11,000 m.,
- for zone - about 11,000 m.

This limit may be increased by raising the antenna by means of the 1st and 4th channels and mainly by means of the 2nd channel.

In raising the antenna with a view to increase the upper height limit it should be borne in mind that it will cause a reduction of the detecting range at all altitudes. Therefore, the antenna should be tilted and raised only in those separate cases when it is necessary to detect a target at the maximum altitudes and higher.

7. Accuracy of coordinate finding:

- slant range ±500 m.;
- azimuth ±0.5°;
- height ±600 m.

The above data are guaranteed only when tracking by means of the azimuth and range indicators at the scale of 50 km. and provided the operator is well trained.

Therefore, when it is necessary to obtain more accurate target coordinates, they should be checked by the azimuth and range indicators.

The increased accuracy in determining azimuth and range values on the plan position indicator may be obtained by passing over to sector scanning at the scale of 80 km., by increasing the scale artificially (through the SCALE 80 km. (МАСШТАБ 80 КМ) and SWEEP CURRENT (ТОК РАЗВЕРТКИ) controls) and by shifting the start of the sweep beyond the limits of the screen. In scanning the targets flying at the ranges exceeding the newly set length of the scale it is necessary to make use of the delay of the range scanning start.

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8. Resolving power:

- range resolution - 400 m.;
- azimuth resolution - 1.3°.

These data refer to all cases (to different targets, ranges, scales and types of indicators).

The maximum resolutions are obtained on the range and azimuth indicators.

To increase the resolving power, if necessary, of the range and azimuth indicators it is advisable:

(a) to set the range scale at 50 km. and, if possible, to increase it by means of the SCALE 50 km. and SWEEP CURRENT controls;

(b) by operating the respective control to set the maximum scale of the vertical sweep instead of 60°;

(c) to make use of connecting the instantaneous automatic gain control (IAGC) circuit, the receiver differentiating circuits, decreasing the amplification of the whole receiver channel and reducing the brightness of the indicator sweep:

(d) to employ the mixer in the amplification duty.

2. RADAR CREW

The combat operation of the radar is carried out by the duty crew comprising:

- duty officer;
- senior operator;
- three operators;
- telephone operator;
- two electrical mechanics.

The duty officer is responsible for the combat operation of the radar. He supervises the work of the crew and personally participates in operational and technical work.

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His operating position is the seat near the mixer СБ-50. He operates the mixer and checks the operation of the whole radar by using the readings of the monitor and signal units, the monitoring oscillographs of units СБ-50 and ДА-01 (range marker unit) and the image on the screen of the plan position indicator. Since the job of the duty officer is rather complicated and important, he should be well trained and should know the tactical capabilities and the operation of the radar equipment.

The senior operator services the plan position indicator. His task consists in detecting targets, determining and transmitting two coordinates (range and azimuth) of these targets and in conducting general surveillance. By the request of the senior operator the target data may be checked by the range and azimuth indicator operator and the height may be determined by the height indicator operator.

The operator of the plan position indicator may find the target height independently of the height indicator operator by switching the slant channel according to the nomograph.

The azimuth and range indicator operator specifies the azimuth and range of the targets indicated by the senior operator, tracks them (during laying) and, if possible, determines additional target data (type of aircraft, number of aircraft in group, type of formation, etc.).

The height indicator operator determines the altitudes of the targets specified by the senior operator.

The operator of the plan position indicator repeater observes the targets according to the instructions received from the officer.

The telephone operator maintains communication with all the subscribers through the switchboard.

The electrical mechanics of the operating and stand-by power plants start the units and supervise their operation.

3. COMBAT OPERATION OF RADAR

During combat operation of the radar the receiver-transmitter equipment is switched on from the central control board. The receiver-transmitter equipment change-over switch should be set to the extreme right position.

It is necessary to cut in all the cabinets of the indicator truck during the time required for placing the equipment in operation. Then, each operator adjusts his indicator while the duty officer checks the operation of the receivers.

(22) Operation of Mixer

After the entire equipment of the radar is switched on completely, the duty officer checks the operation of the receivers and adjusts them in accordance with the oscillograph of unit CБ-50 by switching over the controls on the front panel of the unit (Fig.29).

Check and adjustment of the mixer during combat operation should be carried out as directed in Items 10 - 17, Para. 46 of the present Instructions.

Choice of Modes of Operation

The mixer is designed for three modes of operation:

- amplification mode;
- selection mode;
- combined mode.

In the amplification mode the SELECTOR-OFF OUTPUT (ВЫХОД БЕЗ СЕЛЕКТОРА) change-over switch is ON while the SELECTOR OUTPUT (ВЫХОД СЕЛЕКТОРА) change-over switch is OFF the picture contrast of target markers is worse than in other modes but the resolving power is the maximum.

In the selection mode (the SELECTOR-OFF OUTPUT switch is off while the SELECTOR OUTPUT switch is on) the picture contrast especially in case of interference considerably increases while the resolving power becomes worse (very faint markers of the target are not observed).

In the combined mode (both the SELECTOR-OFF OUTPUT and the SELECTOR OUTPUT switches are on) the picture contrast especially of the faint markers of the target becomes better whereas the resolving power of the radar becomes worse.

The amplification mode is employed in case of absence of interference, when the target is seen distinctly and when high resolving power is required.

The selection mode is used in case of the interference hampering the observation of the target (clouds and active interference).

The combined mode is resorted to in cases of poor visibility and interference as well as during the operation of the radar in the detection mode.

In every specific case the duty officer should choose the mode of operation for the mixer which will provide the best conveniences for the job of the operators.

Cutting In Blanking Circuits

In case of heavy clouds and intensive ground clutter it is good practice to cut out the lower and the middle channels at the beginning of the range in order not to shadow

the indicator screen in the zone of operation of the upper channels. To do this cut in the blanking circuit (by means of the switches located on the right-hand side of the mixer). The length of the blanking pulse is set by the adjusting screw in accordance with the target flight altitude and the radar radiation pattern so as not to cut out the working zone of the lower channels. By the same reasons the blanking of only the lower or the lower and middle channels is cut in.

Cutting In IAGC and Differentiating Circuits

In case of various kinds of interference the protective means are cut in either separately or all at once. In addition to the selector, they include the instantaneous automatic gain control and the differentiating circuits. These circuits are cut in by the IAGC (МАРУ) and DIFFERENTIATOR (ДИФФ) switches of those receivers that are affected by the interference. In combination with the cut-off and amplification adjustments these circuits may be employed for determining the nature of the interference.

(23) Observing Indicator Screens and Taking Coordinate Readings

Depending on the assigned task (detection or homing) the operators employ either this or the other indicator controls and select the required scales of sweep on the screens of the plan position, range and azimuth indicators.

Observing Plan Position Indicator Screen in Different Modes

The plan position indicator ПО-02 may be employed for circular, ring and sector scanning.

To determine the target coordinates, the senior operator uses mainly the electronic marker grid but he also can find the azimuth and range values using only the graphic scales (when the range and azimuth marker units are rendered unserviceable).

For this purpose the electronic marker grid at the 200-km. range scale should be first matched with the graphic scale on the index line, the electric centre (the start of the sweep) should be matched with the mechanical centre of the tube, the sweep trace should pass through the zero division of the azimuth scale when the antenna faces northwards.

The range scales are matched by adjusting the scale of 200 km. and by delaying the start of the sweep of 200 km. The centres are matched by the CENTRE DISPLACEMENT (СМЕЩЕНИЕ ЦЕНТРА) and SECTOR SETTING (УСТАНОВКА СЕКТОРА) knobs with the former being ON.

The north line should always coincide with the zero division of the azimuth scale. If any adjustment is required, it is made by turning the stators of the selsyns in the servomotor unit БСМ-01.

If necessary, the azimuth graphic scale can be illuminated with an ultraviolet lamp. By turning the SCALE ROTATION control the operator adjusts the index line so that it passes through the centre of the target mark. Then the index mark on the index line will show the azimuth value, the position of the centre of the mark on the index line will show the range value.

On the screen of the plan position indicator the target mark is presented in the form of a dot or arc perpendicular to the sweep trace. The duration of the marker glowing depends on the type of the aircraft and its range. In separate cases afterglow keeps on during the

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next three or four revolutions of the antenna. In this case the operator observes the travel of the target in the form of a specific tail.

The electronic range markers are presented on the screen of the plan position indicator in the form of concentric circles spaced at a distance of 10 km. Every fifth circle is brighter and every tenth circle is still brighter which facilitates reading off the range values.

The electronic azimuth markers are presented on the screen in the form of the radial lines spaced at 5°. Every sixth marker corresponding to 30°, 60°, 90°, etc. is made brighter which facilitates reading off the azimuth values.

The target azimuth and range are determined by the use of the electronic markers through interpolation in accordance with the position of the marker centre between the two neighbouring scale lines.

Operation of indicator in ring scanning mode. This mode of operation is used when it is necessary to track the targets at a distance of more than 80 km, of the scale. In this case the start of the sweep is delayed with the RANGE SETTING (УСТАНОВКА ДИСТАНЦИИ) control by the required range and the most distant sections of the range are displayed on the screen. The range that corresponds to the new start of the sweep is taken off the RANGE SETTING scale. In this case the range to the target is found by summing up the readings of the delay scale and the range value from the centre of the sweep to the target mark.

The target azimuth is read off in the same way as in the circular scanning mode.

To avoid burn-out of the tube screen, it should be at all times operated with a delay of not less than 10 - 20 km.

Operation of the indicator in the sector mode is used when it is necessary to scan a certain sector of space on a larger scale. For this purpose the CENTRE DISPLACEMENT switch is put on and by using the CENTRE DISPLACEMENT control the start of the sweep is shifted to the edge of the screen. Then, by manipulating the SECTOR SETTING control the direction of the sector is selected. When the start of the sweep is shifted to the edge of the indicator screen, a sector of about 60° is observed.

The length of the scale at the scale of 80 km. is equal to 160 km. and at the scale of 200 km. it is about 400 km.

In this mode of operation the range and azimuth values are read off by the markers in the same way as in the circular mode.

In the sector mode as well as in the circular scanning mode use may be made of the delay of the range sweep start so as to observe the chosen sector by small portions.

Note: When it is necessary to carry out circular scanning at distances more than 200 km., the radar may be switched over to the scale of 400 km. after being adjusted so that the screen covers 250 or 300 km.

Height Finding by Indicators ПО-02 and ПО-03

To find height, switch over the slant-beam channel for the indicator, in this case two target marks (from the vertical and slant-beam channels) will be observed on its screen. Then, read the target range and the angle between the two target marks and use the nomograph to find the height.

To do this:

(a) illuminate the nomograph with a lamp;

(b) set the index bar by the scale at the obtained angle;

(c) take the height value through interpolation by the lines of equal height against the respective range.

The height may be also found without any electronic markers. In this case the angle and the range should be determined by means of the graphic scales.

Observing Screen of Range and Azimuth Indicator

In the detection mode the operator of the azimuth and range indicator BO-01 works under direct supervision of the senior operator. His task consists in tracking the target allotted to him by the senior operator and determining its coordinates more precisely.

Besides, he finds out the nature of the target (type, number and kind of combat formation of the aircraft).

To determine the coordinates and the nature of the targets more precisely, the operator uses the scale of 50 km. and by manipulating the SECTOR SETTING control presents the required sector of the azimuth while by manipulating the RANGE SETTING control he presents the required range section on the screen. The range is set every 50 or 100 km. and the azimuth every 30^{0}. In this case the central (vertical and horizontal) brighter lines will correspond to those observed on the range and azimuth scales. These lines are considered as initial ones for taking readings.

The target mark is presented on the screen of the range and azimuth indicators in the form of a straight vertical trace. The coordinates are taken in the centre of the mark. To speed up the height finding procedure, the operator of indicator BO-01 should find the target azimuth as accurately as possible and should communicate it to the height indicator operator.

In the homing mode the operator of the range and azimuth

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indicator communicates directly with the command post and his task consists in determining the azimuth and the range of the enemy aircraft and of the friendly fighter and other data requested.

Depending on the task the operator adopts either a 50 or 100 km. scale. With the scale of 50 km., the accuracy of readings is higher but the range scanning zone is smaller and if the distance between the enemy aircraft and the friendly aircraft is above 50 km. the aircraft may be observed only in turn.

Observing the Screen of Height Indicator

To facilitate observing the screen of the height indicator HO-01, its graphic scale should be illuminated with an ultraviolet lamp.

The target mark is presented on the screen of the height indicator in the form of two vertical traces located one above the other at the same distance (from the vertical and slant beam channels).

To determine the target height, the senior operator announces the range and the azimuth of this target and the operator of the azimuth and range indicator specifies them, if necessary.

By using the SECTOR SETTING control, the operator sets the announced azimuth value and tries to match the marker of the vertical beam channel with the starting line of the sweep (first exponential).

Then, by manipulating the handles that shift the graphic scale, he matches the graphic scale with the electronic markers in a narrow section limited by two 10-km. range lines and two 5-degree lines where the marker of the slant-beam channel is located.

The target height is found by interpolating the position of the marker centre relative to the lines of equal heights on the graphic scale.

In tracking a target, the operator should all the time turn the SECTOR SETTING control so that the marker centre of the vertical-beam channel is matched with the starting line of the angle sweep.

When the target azimuth is changed very quickly, the job of the operator becomes more complicated. In this case it is advisable first to find the angle by which the marker is shifted after one turn of the antenna and to adjust the SECTOR SETTING control with an allowance for lead.

If the marker does not coincide with the starting line, the height may be determined with an allowance for an interpolation correction. In this case the accuracy will be somewhat lower but the readings will be taken much quicker.

The height indicator can be used to find the accurate value of the target azimuth. For this purpose it is necessary to match most exactly the marker centre of the vertical-beam channel with the starting line of the sweep and to read the target azimuth off the fine selsyn scale.

(24) Determining Other Target Data

In addition to the three target coordinates the radar station, type П-20, may be used to determine the following target data:

- type of the aircraft (bomber or fighter);
- number of aircraft in the group;
- kind of combat formation;

- aircraft heading and interception course (during homing);

- aircraft speed (with rather a high accuracy).

The type of the aircraft is determined (provided the operator is sufficiently experienced) by the speed of the marker travel per each revolution and by its brightness.

The number of aircraft in the group may be determined with an accuracy of ± 50 per cent. For this purpose all the available means should be employed (reduction of amplification of the reflected signals, introduction of bottom cut-off, connection of the IAGC circuit and the differentiating circuit, reduction of brightness, and the largest scale).

The kind of the combat formation is determined by the contour of the marker, and in separate cases when the distance between the aircraft in the group is increased, by the position of separate markers. In this case use is made of all the available means that can increase the resolving power of the radar and indicators.

The aircraft course is found by the trace or by several separately observed markers. For this purpose the operator of the plan position indicator should determine which of the azimuth marker lines is parallel to the aircraft line of flight. The angle corresponding to this marker line will indicate the aircraft course.

The interception course during homing may be found in the same way. To do this, it is necessary first to determine the interception point directly on the indicator and then to draw an interception line of flight on the indicator by eye and take the course.

The direct determination of the course and, therefore,

the homing is possible when the radar is operated at the scales of 400, 200 km. and at the scale of 80 km. without any delay of the start of the sweep. That is why, at the beginning of homing, if the planes are at a distance of more than 160 km., it is necessary to use the scale of 200 km. with the start of the sweep in the centre or in the sector mode and to pass over to the scale of 80 km. by the end of the sweep, the delay circuits being cut out.

The speed of the aircraft is determined by the flown range with the help of the stop watch or by the number of revolutions of the antenna during the time when the target flies from one ten-kilometre marker to the other. In the second case the speed is determined by the equation:

$$V \text{ km/hr} = \frac{3600}{n}$$

where: n is the number of revolutions during which the target covers 10 km.

(25) Transmission of Target Data

The data from the indicator truck are transmitted through the telephone system. Each operator is equipped with a telephone set. During the operation the type and order of communication are elaborated in accordance with the assigned task. The operator announces aloud the target coordinates before the microphone thus communicating them to the neighbouring operator.

The duty officer who is near the control cabinet may connect his set to any operator's line by means of the switch.

The telephone operator at the switchboard maintains communication between the indicator truck and the subscribers, power plant and the plan position indicator repeater.

Besides, the senior operator and the duty officer may be also connected with the command post through the switchboard. The telephone operator also maintains communication with the telephone exchange.

(26) Peculiarities in Operation of Plan Position Indicator Repeater

The plan position indicator repeater ПО-03 is installed at the command post. The peculiarity of operation with this indicator consists in the possibility of shifting the north line.

For this purpose after the repeater is switched on, the centre of the sweep is precisely matched with the crosshairs on the protective glass of the tube by means of the COARSE CENTRE DISPLACEMENT (СМЕЩЕНИЕ ЦЕНТРА ГРУБО) and the FINE CENTRE DISPLACEMENT(СМЕЩЕНИЕ ЦЕНТРА ТОЧНО) controls.

The antenna is set exactly northwards (according to the scales of the main transmitter unit), while the sweep on the screen of the indicator is shifted to the required position. The sweep trace is shifted over the indicator screen by the NORTH LINE(ЛИНИЯ СЕВЕРА) control. After the adjustment the control is locked and should not be turned during the entire period of operation.

(27) Peculiarities in Operation of Radar In Conditions of Various Kinds of Interference

One of the most important tasks of the duty officer

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consists in taking measures against jamming or against the clutter caused by ground features, clouds, rain, snow, etc.

In case of any interference the duty officer takes appropriate measures. Namely, by cutting out the channels in turn, he finds out through which of the channels the target passes and which of them is affected by the interference and tries to separate them by cutting out the channel subjected to the interference. The latter channel may be periodically switched over to those sectors which are free from any interference. From the moment the interference disappears, the channel is cut in again. The channels are switched on and off by the middle controls in each of the five groups. If the switching of the channels fails to do away with the interference, the duty officer tries to reduce it by cutting in the differentiating circuits, the IAGC circuit and the selector circuit, each circuit separately, all at once or any two of these circuits.

If possible, the officer should try to fill in the gaps caused by the interference and by cutting out separate channels using the swinging of the antenna systems.

In case of intensive interference in the vertical-beam channel the operation of the indicators should not be stopped. In this case the plan position, range and azimuth indicators should be switched over to slant-beam channels which make it possible to determine the range with the same accuracy and the azimuth with an accuracy of the order of $\pm 5^{\circ}$, for which purpose it is sufficient to subtract 12 - 20° (depending on the target range) from the readings of the azimuth scale.

In separate cases when interference on the indicator screen is observed as a narrow sector, the azimuth of the

target that produces the interference is determined by the middle portion of the bright sector and the target range is found by the channel free from interference.

The target azimuth can be also determined by the height indicator. To do this, the operator matches the centre line of the bright sector with the sweep starting line and reads off the azimuth value on the SECTOR SETTING scale.

Besides, if the target is observed through any of the channels (the slant - or vertical-beam channels), its altitude can be found as well. When the vertical-beam channel is affected by interference the operator of the height indicator matches the centre of the bright sector with the sweep starting line and reads the altitude against the second marker.

In the event the slant beam channel is affected by interference, the first matching is performed in a usual way and the altitude is read by reference to the intersection point of the centre line of the bright sector with the vertical line passing through the marker of the vertical-beam channel.

(28) Operation of Radar in Different Weather Conditions

In Different Temperature Conditions

At high ambient temperatures:

1. Put on all the fans in the trucks during and after operation.

2. During long periods of operation of the radar make intervals, if possible, by de-energizing the equipment and leaving the fans on. Open the doors of the cabinets in the indicator truck during intervals.

When the radar operates at low ambient temperatures:

1. In the receiver-transmitter cabin:

(a) avoid sharp changes of temperature in the cabin;

(b) during the intervals warm up the cabin with an electric heater;

(c) put on the cabin fan when the equipment is operating;

(d) check systematically for ice formation inside the waveguides.

2. In the indicator trucks:

(a) heat the wood stove after the equipment is warmed up.

Note: When the ambient temperatures are too low, it is good practice to heat the wood stove during the intervals to avoid sharp changes in temperature;

(b) in order to avoid moisture on the instruments do not heat the stove when the truck is cool;

(c) energize the heater to warm up the operator's legs.

In Conditions of High Humidity

1. In the receiver-transmitter cabin:

(a) open the drain holes in the waveguides once a day;

(b) energize the heater;

(c) check the lubrication of all exposed metal parts of the equipment and lubricate them additionally.

2. In the indicator trucks:

(a) keep the temperature in the truck even;

(b) check the lubrication of all exposed metal parts of the equipment;

(c) avoid accumulation of moisture on the units;

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(d) do not cut out the filament circuits of the unit during the intervals.

In Conditions of Strong Wind

The operation of the radar is allowed at the speed of the wind not higher than 25 m/sec.

If the wind speed exceeds this limit, the operation should be stopped, with the receiver-transmitter cabin not locked and freely rotated by the wind.

In Glazed Frost

The radar operates normally if the reflectors are not coated with ice. To remove ice rotate the transmitter-receiver cabin and energize the station for normal operation. Vibration, as a rule, causes the ice to collapse and fall down. Do not chop off the ice coating from reflectors.

If the foam-plastic covers of the radiators are coated with ice, they should be removed and dried up in the power plant.

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Chapter III

MAINTENANCE AND CARE

1. GENERAL

To keep the equipment in order during prolonged operation of the radar in the field, the following requirements should be observed:

1. Jack up all the trucks and trailers or place them on blocks so that their wheels and springs are relieved.

2. Keep clean all means of transportation, truck bodies, running gear as well as all the equipment.

3. In summer paint the wheels white or protect them with covers.

4. In winter remove snow from the truck bodies and clean the operating site.

5. The cables that hang on the poles should not touch the ground.

6. Put covers on the stand-by connectors of the cable boxes.

7. To avoid corrosion apply a thick layer of lubricant to all the exposed unpainted metal parts of the radar.

8. Place boards under the tracks of truck-tractor.

9. Put boards under the wheels of the two-wheel trailer.

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10. The driver cabs should be closed and nobody should stay there unless it is required.

11. In rainy weather it is good practice to put metal or wooden grates for cleaning shoes before the truck. If no grates are available, use may be made of three branches, bushes, grass, straw, etc.

12. Lay a road to the radar location.

13. Do not pile up unnecessary things near the trucks and under them.

2. PREVENTIVE MAINTENANCE

(29) Daily Inspection

A. Receiver-Transmitter Equipment

W i t h p o w e r s u p p l y o f f

1. Make a visual inspection of the receiver-transmitter cabin and check:

(a) that the receiver-transmitter cabin is levelled properly (the opposite levels should read the same values which should not exceed ± 0.5 div.);

(b) the condition of jacks (remove dust, dirt and corrosion). Remove the old lubricant and apply, if necessary, a thin layer of solid oil, grade M, to the unpainted surfaces;

(c) that the cabin is reliably placed on the jacks; the wheels should not touch the ground and should rotate freely on their axles;

(d) the condition of the trailer frame and the cab; remove dust, dirt and corrosion. If necessary, paint the damaged areas or coat them with a thin layer of solid oil, grade M.

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(e) the condition of the tarpaulin flaps on the receiver-transmitter cabin;

(f) that the brake cable is in the correct position and will not be broken during rotation of the cabin;

(g) the position of the stowage braces(with the cabin rotating, its ladder should not be caught by the braces).

2. Inspect the antenna system and check:

(a) the condition of the reflectors;

(b) the fastening of waveguides and their connections;

(c) the condition and cleanliness of the radiator casings; the air vent holes should be always clean;

(d) the condition of lubricant on all unpainted parts of the antenna system; if necessary, the old lubricant should be removed and a thin layer of solid oil, grade M, should be applied anew. DO NOT LUBRICATE THE FLANGES OF THE WAVEGUIDES;

(e) the drain holes of the waveguides. DO NOT ALLOW THESE HOLES TO GET CLOGGED.

3. Check the condition of the door interlocking contacts of the cabin and the door locks for proper functioning.

4. Open the cabinet of the keyer MH-02, check the condition of the interlocking contacts and remove dust from all the parts.

5. Open the local control cabinet ШУ-02 and remove dust from all its parts.

6. Open the doors of the high-frequency cabinets ША-02 and do as follows:

(a) check the condition of the interlocking contacts;

(b) check the condition of the leads of the magnetron channel;

(c) remove dust and corrosion from all parts.

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7. Check the condition of the antenna switches. Check to see that the armature of the signal mixer gate relay moves smoothly and without jamming.

8. Check the operation of the cabin rotating drive by giving 2 or 3 turns to the cabin manually.

9. Check the limit switch in the cabin rotation interlocking circuit for proper operation.

10. Prepare the receiver-transmitter equipment ~~for~~ switching as directed in Chapter V.

With power supply on

1. Energize the cabin and check the supply voltage.

2. Make sure that the interlocking lamps of the local control board function properly.

3. Turn the switch of the receiver-transmitter equipment to BLOWING (ПРОДУВ) and check:

(a) the condition of all the signal lamps on the local control boards, in high-frequency units and 1500 c.p.s. generator ГА-01;

(b) the operation of all the fans (fans for blowing set ВПЛ-12 cabin and high-frequency cabinets);

(c) the test jacks of the ignition voltage rectifiers ЯП-01 for presence of ignition voltage.

4. Turn the switch of the receiver-transmitter equipment to READY and check:

(a) the timing of the automatic equipment;

(b) the excitation voltage of the set, type ВПЛ-12;

(c) the condition of the signal lamps on the local control boards.

5. Set the switch of the receiver-transmitter equipment to ON and check:

(a) the timing of the automatic equipment;

(b) the discharge phase;

(c) the generator voltage (350 c.p.s.) and magnetron current in the light-load conditions and when it is completely on;

(d) the dischargers of the antenna switch for proper functioning;

(e) the presence of the crystal mixer currents and their value;

(f) the continuity of the AFC circuit;

(g) the gates of the signal mixers for opening;

(h) the presence of noise at the receiver output;

(i) the sensitivity of the receiving channels and, if necessary, adjust the dischargers.

6. Check the operation of the antenna swinging system.

7. Switch over the receiver-transmitter equipment to the remote control and check:

(a) the condition of the signalling system;

(b) the operation of all the units of the remote control system;

(c) the presence of noise and clutter in all the receivers;

(d) that the receiver-transmitter cabin is rotated at the speed of 3 and 6 r.p.m.

8. If necessary, adjust and tune the equipment.

Note: Each time after the radar is de-energized, feel the capacitors of the artificial lines in the keyer and the capacitors of the correction circuit in the high-frequency units for evidence of overheating. Replace the capacitors subjected to overheating.

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B. Indicator Equipment

With power supply off

1. Inspect visually the indicator trucks and the junction cables and check:

(a) the cables for proper connection to the cable entrance box;

(b) the connectors of the telephone line for proper contacts;

(c) the condition of poles supporting the cables (remove the corrosion) and the attachment of the cables to the poles (the cables should not touch the ground).

2. Check for the presence of the suppressor grids on the high-voltage rectifiers of the supply units БП-01.

3. Examine all the cabinets and do as follows:

(a) check the condition of the interlocking contacts (if necessary, wipe them with rags wetted with alcohol);

(b) in winter check the condition of the cables and plug connectors of the heaters;

(c) remove dust, dirt and foreign objects from all the cabinets;

(d) inspect the units for damage;

(e) inspect the condition of the protective glass on the indicators;

(f) check all the controls for condition and security of attachment.

4. Inspect the stoves for condition and make sure that the fire extinguishers are in due place and in ready-for-use condition.

5. Check the emergency lighting.

With power supply on

1. Make sure that the truck body and the compartments in the cabinets are properly illuminated.

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2. Check the instruments and signal lamps on the main control board for defective performance.

3. Energize and check the operation of all the cabinets and units and adjust them, if necessary.

4. Examine valves 6П3С in the supply units. If the anode of the valve is turned red, replace the valve.

5. Check the controls of the mixer for proper functioning.

6. Check the condition and operation of the communication means.

7. Check the clock by the time signals (not less than twice a day).

8. In winter make sure that the electric heaters operate properly.

C. Interrogator-Responsor НРЗ-1

The interrogator-responsor, type НРЗ-1, is maintained according to its operating instructions.

D. Power Plants

The power plants are maintained according to the Service Manual for unit, type АДД-60.

(30) Weekly Inspection

The weekly inspection includes all the procedures carried out during the daily inspection and also the operations described below.

A. Receiver-Transmitter Equipment

With power supply off

1. Check the cables for proper connection and the connections for proper contact.

2. Check the condition of the high-voltage circuit breakers in the keyer unit especially the condition of their contacts and connectors.

3. Inspect the condition of the pulse (cabinets ША-02) and resonance (cabinet МН-02) transformers (make sure that there is no oil leakage and check the insulators for cleanliness).

4. In the local control cabinet check:

(a) the condition of the contacts of circuit breakers ШУ-30, ШУ-29, ШУ-9, ШУ-15, ШУ-86, ШУ-87, ШУ-16 (absence of pits and of contact sticking). When the armature is pressed, all three contacts of each circuit breaker should touch their respective contacts simultaneously;

(b) the condition of the trimming chokes (special attention should be paid to the clearances of their cores);

(c) the condition of the through insulator of the spark-gap (remove dust and dirt from its surfaces);

(d) the reliability of the rheostat slide contact in the exciter circuit of the set, type ВПЛ-12.

5. Check the resistance of the absorbing washers in the signal mixers and AFC.

6. Check the orientation of the antenna by the scale readings of the main transmitter unit.

7. Check the condition of the filters in the vent holes.

8. Check the condition of the dog clutch in the cabin rotation reduction unit and the condition of oil in the reduction unit. If necessary, pour in some oil.

9. Wipe the ceramic insulators and capacitors in the keyer and high-frequency units with clean rags wetted with alcohol.

10. Check the condition of the electrodes of the spark-gap in the set, type ВПЛ-12, and, if necessary, replace the burnt electrodes as directed in Paragraph 52.

W i t h   p o w e r   s u p p l y   o n

1. Check the reliability of operation of all the switches.

2. Check the operation of the emergency protection automatic equipment.

3. Check the currents and voltages in the test jacks of the receivers, supply units and of the ignition voltage rectifiers.

4. Check the klystron heterodynes for proper adjustment and the AFC circuit for proper operation.

B. Indicator Equipment

W i t h   p o w e r   s u p p l y   o f f

1. Remove all the units (without disconnecting the cables) from the cabinets.

Inspect the units and check:

(a) whether the valve bulbs are intact and whether they are not loose in their bases;

(b) that the cathode-ray tubes are fastened reliably;

(c) that the high-voltage wires are attached and insulated reliably.

2. Remove the suppressor grid from the high-voltage rectifier of supply unit, type БП-ОI, and check the condition of the anode leads of valves B1-0.02/20 and 6BC1. Check the condition of the high-voltage through insulator. While putting the suppressor grid in place see to it that all the high-voltage wires are not less than 5 cm. away from the chassis.

3. Remove dust from air filters in each cabinet.

4. To remove dust, blow off all the units with compressed air.

W i t h p o w e r s u p p l y o n

1. Check the operation of the servo system, matching of zeroes on the scales of the selsyns and indicators and check the servo motor unit for uniform rotation.

C. Power Plant

1. Inspect the generator and check its parts and contacts for proper attachment.

2. Wipe the commutator of the exciter with clean rags wetted with alcohol.

3. Check the pressure of the exciter brushes (it should be about 110 - 200 gr/cm^2).

4. Check the exciter cross-member for proper position.

5. Examine the control and distribution boards. Blow off the wiring with compressed air.

6. Check the Diesel-engine for proper alignment with the generator.

7. Carry out maintenance operations on the engine in accordance with the Service Manual for unit АПД-60.

8. Check the condition of bearings in the set, type ВПЛ-12. (To be done during the disassembly after 2000 - 2500 operating hours).

9. Inspect the equipment for missing units and check its condition and serviceability.

10. Restore the varnish and paint coating.

<u>Note:</u> If at the moment of switching on the radar its separate units are found unserviceable and their defects cannot be removed by the crew at once, it is necessary to replace the defective unit by a spare one and to check and repair the removed one.

(31) Monthly Inspection

The monthly preventive maintenance includes the daily and weekly preventive measures plus the operations described below.

A. Receiver-Transmitter Equipment

W i t h p o w e r s u p p l y o f f

1. Check the pressure of the brushes (it should be 200 gr/cm^2), the condition of the slip rings and commutator of set ВПЛ-12. Wipe the rings and the commutator with clean rags soaked with alcohol. If the rings are burnt, clean them with fine glass paper (No.000).

2. Clean the T-R cell, type AP-2, from dust and dirt.

3. Inspect the condition of the selsyns in the main transmitter unit and wipe the slip ring of the selsyns with clean rags wetted with alcohol.

4. Inspect the friction parts of the switches, relays and contactors and, if necessary, coat them with a thin layer of lubricant, grade ВМП, check the screws of these parts for proper tightening.

5. Check the condition of contacts in all relays and contactors and, if necessary, clean the contacts with glass paper No.000 or wash them with alcohol. Pay special attention to the reliability of operation of the contacts in circuit breakers, type АД.

6. Inspect the condition of the contact connectors on the side panel of the local control cabinet (from the side of the cabin heater) and, if necessary, tighten up the contact springs.

7. Wipe the magnetron coupling (CM) with a soft cloth wetted with alcohol.

8. Blow the carbon dust off the rings and brushes of current collector TK-02 and especially off the lower power rings with compressed air. Inspect the rings and brushes for condition and wipe the rings with clean rags (without alcohol). Check the rings and brushes (especially the channels of the receiver output) for permanent resistance when the cabin is rotated manually. The brush-ring resistance should be not more than 1 - 2 ohms and should not change during rotation.

9. Inspect all hinge connections of the cabin rotation hand drive for proper lubrication and lubricate them, if necessary.

10. Examine the condition of storage batteries, wipe them and charge, if necessary.

11. Check the availability and condition of the spare equipment, measuring instruments and tools.

12. Replace the lubricant in the hoisting jacks and hinge connections.

13. Take the units of the receivers, receiver supply rectifiers, ignition voltage rectifiers and the generator (1500 c.p.s.) out of their compartments and do as follows:

(a) check them for swollen or burnt resistors and capacitors;

(b) inspect the condition and cleanness of the insulators and soldered joints, if necessary, wipe the insulators with rags wetted with alcohol;

(c) check the condition of the insulation and wiring;

(d) blow off the wiring with compressed air.

14. Pack the blade bearings of fans of the set, type ВПЛ-12, and of fans for airing the cabin with lubricant, grade ЦИАТИМ-201.

15. Level the receiver-transmitter cabin precisely.

W i t h   p o w e r   s u p p l y   o n

1. Check the stand-by receiver and the stand-by power supply unit for proper functioning.

2. Check the operation of all the instrumentation.

3. Check the servo system for proper matching and adjust it if necessary.

B. Indicator Equipment

W i t h   p o w e r   s u p p l y   o f f

1. Disconnect all contact connectors and take the units out of the compartments. Check the condition of the contact connectors and clean them, if necessary.

2. Inspect the wiring of the units and do as follows:

(a) check the units for swollen or burnt resistors and capacitors. Inspect resistors 101, 102 and 103 in the units of plan position indicator, plan position indicator repeater and selsyn repeater;

(b) inspect the condition and cleanness of the insulators and soldered joints. If necessary, wipe them with rags soaked with alcohol;

(c) inspect the condition of the insulation and wiring;

(d) blow off the wiring with compressed air;

(e) inspect the condition of all relays and contactors in the supply units.

3. Inspect the external condition and fastening of the fans in the supply units. Wipe the impellers of the fans.

4. Inspect all the switches and if the contacts are burnt wipe them with rags wetted with alcohol. If necessary, the retainers and bearings of the switch pins should be coated with a thin layer of lubricant, grade BMП.

5. Inspect all the friction parts of the relays and contactors and, if necessary, coat them with a thin layer of lubricant, grade ВМП.

6. Inspect the rings and brushes of the servo system components. If necessary, replace the brushes.

7. Check the condition of the gears and bearings of inductors, types ТП-03 and ТУ-02, and oil them with the ВМП lubricant, if necessary.

8. Check the availability and condition of the spare equipment, measuring instruments and tools.

With power supply on

1. Check the servomotor units in the plan position indicator ПО-02, the plan position indicator repeater ПО-03 and the selsyn repeater ХА-01 for smooth operation. If necessary, lubricate the reduction unit with ЦИАТИМ-201 lubricant.

2. Check the servo system for proper matching and match it, if necessary.

3. Check the selsyns of the reflector tilt angles for correct indication.

C. Power Plant

Inspect the power plant according to the Service Manual for unit АПД-60.

(32) Six-Month Inspection

The six-month inspection includes the daily, weekly and monthly preventive maintenance plus the operations described below.

1. Take electric motors, type СЛ-262, out of the recesses and clean them from the carbon and graphite powder. Wipe the commutators with rags wetted with alcohol.

2. Check and, if necessary, replace the lubricant in the electric motors of fans, type ДТ-75. The check and lubrication procedure is described in the present Instructions.

3. Inspect the cables for condition and shielding; check the resistance of their insulation.

4. Lubricate all the units of the radar in accordance with the present instructions.

5. Clean and wash the entire waveguide channel with water and then dry it up.

6. Replace the electrolyte in the storage batteries.

7. Check the field intensity of the keyer permanent magnets. Use the magnet shunt to set the normal intensity of the magnetic field (2750 oersteds).

Operation of Electric Motors, Type СЛ-262

The electric motors require careful and proper handling.

While installing them in place wash carefully the ends of the shaft with aviation gasoline and do not allow any of the electric motor parts to be struck. The electric motor is adjusted by the Manufacturer, therefore do not touch its fastening screws.

During weekly inspections clean the commutator of the electric motor from carbon powder, wipe it with gauze wetted with pure alcohol. DO NOT USE COMMERCIAL ALCOHOL OR OTHER LIQUIDS FOR WIPING THE COMMUTATOR.

In case of heavy sparking of the brush remove carbon powder from the commutator and increase the tension of the spring or replace the brush by a new one and grind it in.

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The terminal plate should be kept clean. While installing the motor check the plate for proper and reliable connection.

The motor should be kept only in a dry room at a temperature of 20$\pm$5°C and it should not be left unprotected on benches or racks, etc. unless it is required by circumstances.

The strip on the front cover should be always closed. While replacing the brushes do as follows:

1. Check the brush for proper connection with fittings (spring, strand).

2. Insert the brush into the clamp (The brush should fit the clamp freely and should drop out of it under its weight).

3. Once the brushes are replaced, they should be grinded in for 8 hours by idle running (without any load).

Make sure that the sparking of almost the half of the brushes does not exceed 1.5 degrees weak (according to the State Standard 183-55).

4. As the brushes are worn out, screw in the metallic cap and plastic plug.

5. If the sparking of the motor is normal, the brushes should be changed roughly every 500 operating hours.

6. Do not operate the motor whose brush is less than 6 mm long.

Preventive Maintenance of Electric Motors, Type ДТ-75, Employed as Fan Drives

During the assembly the bearings of electric motors, type ДТ-75, are lubricated with grease, grade 1-13.

During yearly inspection of the equipment check the bearings of the electric motors, type ДТ-75, for presence and condition of grease.

To do this:

1. Disconnect the wiring conductors leading to the motor

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and to the centrifugal relay, type ЦР-1 (after removing the relay housing). At this time the power supply of the respective unit should be cut out.

2. Remove the fasteners of the fan units and take the assemblies out of the equipment units (supply units БП-01, radio-frequency units ША-01, keyer unit МН-03).

<u>Note:</u> A. Take the magnetron blowing fan out of the radio-frequency unit in the following order:

- remove the ignition voltage rectifier, then drive out 4 screws and remove its casing;
- remove the clamp fastening the fan power supply cable;
- drive out 4 bolts of the shock absorbers and release the fan plate with the volute chamber;
- pull the fan unit out of the cabinet (in the fans of the recent design the necessity may arise to drive out the right-hand bolt near the neck of the air conduit).

B. Take the fan out of the radio-frequency unit in the following succession:

- remove the upper left-hand facing sheet from the cabinet;
- remove the fasteners securing panel ШБ-03 to the frame and move the panel aside without disconnecting the wiring;
- pull out and lower the magnetic board;
- remove the fasteners and take pipe with the louvres out of the cabinet;

- drive out 4 bolts of the shock absorbers and release the plate with the volute chamber;
- pull the fan out of the cabinet.

3. Take the fan impeller off the shaft nose piece (with the help of the remover), separate the electric motor and the block from the plate with the volute chamber.

4. Take the centrifugal relay from the other nose piece of the shaft:

- drive out the screws and remove the other section of the relay housing;
- remove 2 brushes from the relay body and the spring from the relay rotor;
- back off the screw at the end face of the shaft and remove the relay rotor by means of two screw drivers;
- drive out 3 screws and remove the relay body.

5. Drive out 3 screws holding the bearing cover from each end of the shaft, remove the cover and the adjusting shim.

6. Check each bearing and the cover for presence and condition of lubricant:

(a) if the lubricant has not turned solid or contaminated, add some grease, grade I-13, or ЦИАТИМ-201 until 2/3 of the bearing chamber is filled up;

(b) if the lubricant has turned solid or contaminated, remove the old lubricant and apply a new grease, grade I-13, or ЦИАТИМ-201 until 2/3 of the bearing chamber is filled up.

7. Put an adjusting ring, cover and turn in 3 screws on each end of the motor shaft.

8. Secure the motor on the plate with the volute chamber and fasten the adapter block. Mount the fan

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impeller on one nose piece of the shaft and the centrifugal relay on the other nose piece (there are 3 small threaded holes for fastening the relay body to the bearing cover of the electric motor from the side of the relay).

The relay is mounted in the following order:

- put the relay body on the shaft and secure it to the bearing flange of the motor with three screws;
- put the relay rotor on the shaft of the electric motor and secure it in the end face of the shaft by means of a screw;
- place the brushes into the relay body;
- put the main section of the housing on the relay body.

9. Install the fan unit (motor - fan - relay) into the equipment unit in the order reverse to the disassembly (See Point 2).

Connect the ends of the wiring to the relay brushes and to the respective lugs of the motor block. Put the other section of the housing on the relay body.

10. Check the electric motor for proper connection and the fan impeller for direction of rotation which should correspond to the direction of the arrow inscribed on the housing (volute chamber) of the fan. If the connection is correct, solder the wires to the plate (on the supply units БП-01).

Prior to installing a new electric motor, type ДТ-75, (from the S.P.T.&A. set) it is necessary to check the motor bearings for presence and condition of lubricant and, if necessary, add grease, grade I-13, or ЦИАТИМ-201 as directed in Items 5 and 6.

The fan unit is assembled and installed in the equipment units as directed in Items 7, 8, 9 and 10.

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If the equipment that includes the motors, type ДТ-75, has been used in dusty areas or under high humidity for a long time, the lubrication check should be carried out not during the yearly inspection but after 6 - 8 months of operation.

Maintenance of Crane and Its Lubrication

To maintain the crane, to keep it always ready for operation, to prevent damage and breakage of the crane, its working parts should be checked periodically.

The crane should be inspected not less than once a month, special attention being paid to the following:

1. The parts of the crane should be free from corrosion; all traces of corrosion should be removed.
2. After each transportation of the crane (prior to or after the installation) the following units should be thoroughly wiped and coated with protective lubricant: pulleys, rope, drum, winches, lockpins, hinges and the lifting mechanism of the winch. Dirt and dust should be also removed from other parts of the crane.
3. The pulleys should rotate freely when turned.
4. Lockpins, braces and the jibs should be securely fixed in the working position.
5. The safety handle of the winch should be adjusted and thoroughly lubricated.
6. The case of the winch planetary gear should be packed with grease up to 2/3 of its capacity.

The presence of the grease in the case is checked every month; the grease is usually replaced twice a year.

7. Force the lubricant, grade ЦИАТИМ-201, into the grease fittings of the pulley shafts and axles of the lower and upper supports.

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Each time before starting the operation of the crane inspect the rope throughout its entire length.

The number of the broken wires should not exceed 4 through one meter of its length. Bends, loops, flattening and unwinding of the rope are not tolerable.

Maintenance of Two-Wheel Trailer

The trailer should be given a monthly preventive inspection. During the inspection special attention should be paid to the following:

1. The play of the roller bearings should be within 0.08 - 0.15 mm.
2. The jacked wheel should be turned easily by one hand and should make not less than five revolutions after it is turned. Then the wheel should stop smoothly and make a swing brackwards.
3. The lubrication of the parts of the trailer should be carried out according to the Table given below:

Parts to be lubricated	Lubrication points	When refilled	When changed
Roller bearings	Hubs 2	Simultaneously with preventive maintenance of truck	During six-month inspections after washing with kerosene
Spring splines	Lubricator fitting 6		
Springs	Between sheets		
Drawbar ring	Bearings		

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The trailer is lubricated with a solid oil, grade M, in summer and grade Л in winter. The springs are lubricated with graphited oil.

UNDER NO CIRCUMSTANCES SHOULD THE WHEEL (DISC) OF THE TRAILER BE MOUNTED (DURING REPLACEMENT) WITH THE CONVEXED PORTION OF THE DISC INSIDE THE TRAILER, OTHERWISE THIS WILL INEVITABLY RESULT IN BREAKAGE OF THE TRUNNION OF THE ROLLER BEARING AXLE.

3. LUBRICATING INSTRUCTIONS

The components of the running gear as well as the electric mechanisms should be periodically lubricated. The grades of the lubricants and the lubrication frequency are different for different units. Following is a list of the units that are to be inspected and lubricated.

1. Trailer for transmitter-receiver cabin. The front wheel locks are lubricated with solid oil, grade M, in summer or with grease in winter every 1000 km.

The pins of the transverse steering rods are lubricated with solid oil, grade M, in summer or with grease in winter every 1000 km.

The brake gear segment is lubricated twice a year with solid oil, grade M, in summer and with grease in winter. The brakes and the brake levers are lubricated with solid oil during assembly and repair.

The bearings and gears are filled with the АФ-70 or ЦИАТИМ-201 lubricant during assembly or repair. The screw of the jack is packed with solid oil once a month. The bearings of the front and rear wheels are filled with solid oil in winter and in summer every 2400 - 2700 km. To do this, remove the hub, wash off the old lubricant and fill in the new oil by means of a lubricator.

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The hinge joints that are not provided with lubricator fittings (the brake tie-rods, wheel adjusting tie-rods, etc.) are filled with the same lubricant as the oil dries up or becomes contaminated (Fig.30). In winter at temperatures below -5° the grease is packed by the grease gun until the fresh oil appears in the holes.

2. Turning mechanism. The thrust bearing of the turning mechanism is lubricated with the АФ-70 or ЦИАТИМ-201 oil by means of a grease gun through the lubricator fittings mounted on the fixed plate every 1000 hours of continuous operation. About 200 - 250 cu.cm. of grease should be pressed into each lubricator fitting.

The lower balls of the race ring are lubricated with the АФ-70 or ЦИАТИМ-201 oil through the bolt with the lubricator fitting which fastens the cabin to the race ring. The bolt is located on the right side of the cabin rotation motor.

The centring bearing of the turning mechanism is packed with the АФ-70 or ЦИАТИМ-201 lubricant through the lubricator fitting that is located on the bearing flange. The lubricant is applied through the hole in the rotary joint pedestal by means of a lubricator.

3. Cabin rotation mechanism. During assembly the bearings of the electric motor are packed with ЦИАТИМ-201 lubricant. The inspection is carried out twice a year.

The shaft and the bearings of the reduction unit are lubricated with the АФ-70 or ЦИАТИМ-201 grease during assembly or repairs. Inspect and change the lubricant every 750 - 1000 hours of operation. The following grades of liquid lubricant are filled into the case:

(a) grade МК-22 at the temperature of from $-5^{\circ}C$ up to $+50^{\circ}C$;

(b) grade MC-14 at the temperature of from +15°C to - 30°C;

(c) spindle oil, grade АУ at the temperature of below - 30°C. The amount of oil filled in up to the upper notch of the oil level gauge is about 4 kg (Fig.31).

Note: While filling in the reduction unit with oil it is necessary to keep the rubber rings of the electric motor drive clutch from getting oil on them.

The oil is changed every 200 - 400 hours of operation.

The maximum temperature of the reduction unit body during operation should not exceed the ambient temperature by more than 25 per cent (not higher than 75°).

The lower bearings of the output shaft are lubricated with the АФ-70 grease through the ball-type lubricator fitting in the clamping bolt by means of a lubricator. To lay bare the head of the bolt, it is necessary to remove the upper spherical cover.

4. Hand drive. The bearings of the hand drive should be lubricated with the motor oil only during assembly and repair. The roller chain should be washed and lubricated as it becomes dirty.

5. Fans and rotary joints. The bearings of the fan electric motors except the motor, type ДТ-75, should be packed with grease, grade ЦИАТИМ-201, only during assembly and repair. The inspection should be carried out after 1000 - 1500 hours of operation

The lubricant and the lubrication frequency of the blade bearings are the same. The bearings of the rotary joint are lubricated with the same grade grease during assembly.

6. Increased frequency motor-generator set. During assembly the bearings of the electric motor and the generator are packed with the grease, grade ЦИАТИМ-201.

The grease is changed after 2000 - 2500 hours of operation during the preventive disassembly of the unit.

Prior to assembling the motor-generator set with the exciter the clutch springs and the holes for their shafts should be coated with grease, grade ЦИАТИМ-201.

7. Swinging mechanism. The bearings of the electric motor should be packed with the lubricant, grade ЦИАТИМ-201, by half the volume of the bearing body; about 2/3 of the volume of the reduction unit body are filled with the lubricant, grade АФ-70, or ЦИАТИМ-201. The motion screws, spline grooves, hand drive worm and the worm of the power drive are packed with the same lubricant. After 1000 hours of operation the lubricant is checked and changed if contaminated (Fig.32).

The open hinge joints: pins, ears and other friction parts are coated with a thin layer of the solid oil, grade M (whenever it becomes dry or dirty).

8. Separate units. Separate units that are mounted in the cabinets: relays, contactors, switches and other friction parts should be coated with a thin layer of the lubricant, grade ВНП (whenever it becomes dry or dirty).

9. All exposed surfaces. All exposed surfaces unprotected anyhow from corrosion should be coated with the solid oil, grade M.

10. In the indicator equipment and simulator units, all the friction parts of the mechanisms which are made in the enclosed housings should be lubricated with the grease, grade ЦИАТИМ-201, only during inspection and repair.

11. In the plan position indicator. In addition to the above listed the following parts should be lubricated: hinges and the gears of the centre expansion mechanism.

12. In the telephone panels lubricate the gears and bearings of the inductor.

13. In the cable brackets lubricate the bushes and lock screws.

14. In the seats lubricate the screw and nut.

15. In all joints and everset screws lubricate the threaded portion.

16. In all rotary switches lubricate the retainer and the axle bearing.

All the units mentioned in Items 11 to 16 should be coated with a thin even layer of the grease, grade АФ-70 or ЦИАТИМ-201, applied throughout the entire working surfaces every 150 - 200 hours of operation.

The bell bearings should be lubricated with the grease, grade АФ-70 or ЦИАТИМ-201 (pack the bearings until they are filled to capacity).

Note: While substituting the grades of the oil in the drive mechanisms, do not mix the oils of different grades.

4. PREPARATION OF THE RADAR FOR STORAGE

In preparing the radar for storage, do as follows:

1. Pack the radar as is directed by the present Instructions. The cases into which the parts of the radar are to be packed should be filled up with wood shavings.

2. Jack up all the trucks and the receiver-transmitter cabin so that its wheels are clear of the ground.

3. Wash all the fasteners removed from the antenna-waveguide equipment with gasoline and coat them with a thick degreased lubricant (solid oil).

4. Wash all the lubrication points with gasoline and coat them anew with solid oil.

5. Wash and lubricate all the joints of the radar with lubricant, grade ЦИАТИМ-201.

6. Wrap up all the exposed surfaces coated with chassis lubricant with thin dense paper.

7. To prepare the radar for a long-term storage, drain the oil from the cabin rotation reduction unit, wash it with gasoline and fill it with fresh thick oil.

8. Remove all the moisture absorbers from the oil transformers and plug the holes in the tanks.

9. Close the grate of the increased frequency motor generator set with dense paper.

10. Close all the hatches of the truck.

11. Put additional rubber packings on the side cover of the motor generator set.

12. Close all the fans and filters.

13. Disconnect all the wires leading to the storage batteries from the terminals. Pay special attention to the disconnection of the storage batteries in the receiver-transmitter cabin.

14. Slush the storage batteries in accordance with the corresponding instructions.

15. To prepare the radar for a long-term storage, remove the contact brushes from all the motors and from the rotary joint.

16. If the radar is to be stored outdoors, the canopy of the receiver-transmitter cabin should be covered with ruberoid or tar paper.

17. Reduce pressure in the tyres of the trucks and trailers to the minimum. Paint the tyres white and protect them by wooden cases. During the long-term storage the radar should be given a thorough visual inspection not less than once a month.

Chapter IV

ADJUSTMENT

1. ADJUSTMENT OF RECEIVER-TRANSMITTER EQUIPMENT

The following units in the receiver-transmitter cabin are subject to adjustment and tuning:

1. Radio-frequency units.
2. Spark-gap of the increased frequency motor generator set, type ВПЛ-12.
3. Receiver.
4. Antenna switch.
5. Generator, 1500 c.p.s.

Operation check and tuning are carried out in all cases when the valves, dischargers, germanium detectors or any other units or parts are replaced as well as in case of any fault in the unit or after a long interval in operation of the radar.

(33) Measurement of Magnetron Generator Frequency

The frequency should be measured after the magnetron is replaced, the position of the magnetic shunt is changed, the waveguide channels or the radiator are repaired as well as during the adjustment of the clystron heterodyne of the receivers.

Frequencies (in Mc/s) of the radio-frequency generators should be covered within the following ranges:

for unit No.1 (Г), magnetron, type МИ-25-2965-2995;
for unit No.2 (А), magnotron, type МИ-22-2695-2725;
for unit No.3 (Д), magnetron, type МИ-26-2995-3025;
for unit No.4 (Е), magnetron, type МИ-89-3035-3115;
for unit No.5 (В), magnetron, type МИ-24-2815-2845.

Note: In some radars channels E are substituted by channels Б, magnetron, type МИ-23, with the frequency of 2725 - 2755 Mc/s.

The magnetrons whose frequencies are not covered by the above ranges should be placed in the channel with the respective frequency range. Then, its frequency should be measured again. The frequency of the magnetron generators is measured by the radar tester, type PT-10. The measurement should be carried out in the following order:

1. Install the instrument, type PT-10, on unit No.3.

2. The longer cable (3 m.) is inserted with its bigger connector in the WAVEMETER AND PT-10 POWER METER INPUT (ВХОД ВОЛНОМЕРА И ИЗМЕРИТЕЛЯ МОЩНОСТИ PT-10) jack (bottom, right).

The smaller connector of the cable is connected to the directional coupler of the antenna switch of the unit to be measured.

3. Connect the power supply cable to the block on the rear side of instrument PT-10 and insert it into the 220 V A.C. mains. Turn the mains switch to ON.

4. Set the WAVEMETER ATTENUATOR (АТТЕНЮАТОР ВОЛНОМЕРА) control to the extreme left position.

5. Calibrate the PT-10 instrument for which purpose: set the CALIBRATION-MEASUREMENT (КАЛИБРОВКА - ИЗМЕРЕНИЯ) switch to CALIBRATION (КАЛИБР) and the LEVEL INDICATOR - POWER METER (ИНДИКАТОР УРОВНЯ - ИЗМЕРИТЕЛЬ МОЩНОСТИ) switch to POWER METER (ИЗМЕРИТЕЛЬ МОЩНОСТИ).

(a) turn the BALANCE SETTING - READING - ZERO CHECK (УСТ.БАЛАНСА - ОТСЧЕТ - ПРОВЕРКА НУЛЯ) switch to READING and by manipulating the ZERO SETTING knob set the pointer of the instrument to zero at its lower scale;

(b) place the BALANCE SETTING - READING - ZERO CHECK switch to ZERO CHECK and by manipulating the COARSE (ГРУБО) or FINE (ТОЧНО) knobs set the pointer of the instrument to zero at its lower scale;

(c) turn the BALANCE SETTING - READING - ZERO CHECK switch to BALANCE SETTING and by manipulating the COARSE or FINE knobs set the pointer of the instrument at the red line.

6. Place the BALANCE SETTING - READING - ZERO CHECK knob to BALANCE SETTING. Set the CALIBRATION - MEASUREMENT switch to MEASUREMENT.

7. By smoothly turning the WAVEMETER ATTENUATOR knob set the pointer of the instrument in the middle of the scale.

8. By turning the WAVEMETER knob find the position in which the pointer of the instrument makes a sharp throw to the left, to the minimum. Count the divisions through the holes in the wavemeter and find the frequency generated by the magnetron by using the table supplemented to the PT-10 instrument.

Note: To avoid burning of the thermistor in the wavemeter, cut in the attenuator only during measurements.

(34) Checking Frequency Spectrum of Magnetron Generators

The frequency spectrum of the magnetron generator is measured after replacing the magnetron or after the position of the magnetic shunt is changed.

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Prior to measurement the equipment should be warmed up for 15 - 20 min. under a normal mode of operation.

The frequency spectrum is checked by means of the oscillograph. To do this:

1. Cut in the oscillograph with the continuous sweep in the AFC PULSE socket of the echo signal receiver (unit E9-02), turn the ASC - MSC control to MSC and rotate smoothly the MSC potentiometer. If in this case with the potentiometer in the middle position (klystron basic generation zone) positive and negative pulses are observed only once, the magnetron spectrum is considered satisfactory (it has no considerable humps). If any pulses are observed twice, the spectrum of such a magnetron is considered bad (it has rather big humps).

   Note: The repeated pulses that appear in the side generation zone of the klystron may be observed with the MFC potentiometer in the extreme positions.

2. If the magnetron spectrum is good, the AFC should function properly and the AFC pulses should be distinctly observed on the oscillograph.

(35) Setting Discharge Phase of Rotary Spark-Gap

Do not cut in the increased frequency motor-generator set when the suppressor grid of the rotary spark-gap is removed, and do not look at the discharge without protective glass for a long time (for more than 1 min).

The discharge phase of the rotary spark-gap is checked and adjusted after its tungsten pins are replaced, during the repair of the spark-gap or when the frequency of the power supply mains is changed by more than ±1 c.p.s. The absence of the interference traces that are evenly observed on the indicators within

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the radius of 40 - 60 km. signifies that the discharge phase is normal.

The discharge phase is checked by means of the oscillograph with the continuous sweep under normal operating condition of the transmitter equipment. During the check use should be made of the instructions for this oscillograph. To make a check, do as follows:

(a) place the oscillograph on a turntable;

(b) connect the oscillograph to the mains according to the instructions;

(c) connect the shielded cable with a plug to the input of the oscillograph;

(d) insert the plug of the cable into the socket on the local control board which bears an inscription DISCHARGE PHASE (ФАЗА РАЗРЯДА);

(e) by manipulating the AMPLIFICATION and SWEEP FREQUENCY (УСИЛЕНИЕ И ЧАСТОТА РАЗВЕРТКИ) knobs ensure that the image on the screen of the oscillograph occupies half the screen vertically and that 2 - 3 cycles are displayed within the sweep;

(f) the shape of the oscillogram should be such that a sharp drop is exactly in the middle of the positive half-cycle, then should follow a slight rise above the zero line and at last transition to the negative half-cycle (Fig.33);

(g) if the line of drop does not pass through the middle of the peak of the positive half-cycle, it is necessary to loosen two lock screws on the stator of the rotary spark-gap and by turning the handle of the spark-gap set the required discharge phase and secure the stator of the rotary spark-gap by the lock screws again.

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(36) Tuning the Receiver and Antenna Switch

The tuning of the receiver and antenna switch includes:

(a) check the tuning of the gas dischargers;

(b) tuning of the receiver klystron heterodyne;

(c) ensuring of coupling of the heterodyne with the mixers of the automatic frequency and signal control;

(d) check of operation of the AFC channel;

(e) measurement of the receiver sensitivity.

All the operations listed above should be carried out in the normal mode of operation of the receiver-transmitter equipment. Prior to starting the operation the receiver-transmitter equipment and the measuring instruments should be warmed up for 15 - 20 min.

To operate the receiver and the antenna switch, the following measuring instruments and special tools are required:

(a) oscillograph with driven sweep;

(b) two instruments, type PT-10 (one being installed on radio-frequency unit No.3 with the front panel facing the centre of the cabin, the other on a special rack of the 1500 c.p.s. voltage generator unit);

(c) microammeter (100 and 300 μA) with a shielded wire and a plug;

(d) instrument, type TT-1;

(e) flat wrench for gas dischargers;

(f) combination wrench-screwdriver for the klystron circuit;

(g) cable with two eight-contact connectors.

Check of gas dischargers is carried out after the replacement of the dischargers, after a repair or continuous operation of the antenna switches and each time

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prior to starting the operation of the station.

The round side discharger is checked by the tint and nature of its glow in the operating transmitter. The glow should be uniform, of violet colour, without sparking. If the discharger starts to spark or its glow turns white, it should be replaced.

The rectangular discharger is also checked by the glow through a special hole in its housing. Besides, it is necessary to check the joints of the discharger with the waveguide for penetration of high frequency through the packing. To do this, bring neon lamp МН-3 to the joints. The glow of the lamp signifies that the frequency penetrates through the packing. In this case it is necessary to tighten up the four holding screws or to check the lead and spring gaskets of the discharger. If the gaskets are defective, they should be either repaired or replaced by new ones.

Note: Do not tighten the holding screws of the rectangular discharger excessively, otherwise the glass of the discharger may be broken or the edging can be displaced.

The round discharger of the signal mixer is checked by measuring the current of the ignition voltage rectifier of the discharger.

In this case do as follows:

1. Open the lower left-hand hatch on the front door of the radio-frequency unit.

2. Insert the microammeter (300 μA) by means of the wire with a plug into the IGNITION CURRENT (ТОК ПОДЖИГА) socket on the panel of the ignition voltage rectifier.

If the discharger and ignition rectifier are sound, the pointer of the microammeter should indicate from 90 to 150 μA.

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3. If there is no current, it is necessary to cut out the single-contact connector located at the bottom of the round discharger of the signal mixer and to check it by means of instrument TT-1 for presence of constant voltage; it should be within the limits of 500 - 900 V. If the voltage is not available, replace the kenotron or repair the ignition voltage rectifier. If the voltage is available but there is no ignition current, replace the discharger and check the resistance (3.9 megohms) across the connection of the antenna switch.

Klystron Heterodyne is tuned:

- during replacement of the receiver;
- during replacement of the klystron;
- during replacement of the magnetron;
- in case of mistuning of the klystron heterodyne as a result of continuous operation.

Replacement of receiver by stand-by one. If the main receiver becomes disabled, it should be replaced by a stand-by one. In this case it is good practice to put the klystron and its circuit from the removed receiver into the new one. Then it may be unnecessary to tune the heterodyne.

While replacing the receiver it is useful to know the distribution of frequencies in the klystron heterodynes.

Table 1

Frequencies of Magnetron Generators and Klystron Heterodynes

Channel number	Frequency in Mc/s of magnetron	Frequency in Mc/s of klystron	Relation of magnetron and klystron frequencies	Engraving on side panel of receiver
1	2980 ± 15	2950±15	$f_{kl} < f_{mag}$	H
2	2710±15	2680±15	$f_{kl} < f_{mag}$	H
3	3010±15	3040±15	$f_{kl} > f_{mag}$	B
4	3100±15	3140±15	$f_{kl} > f_{mag}$	B
5	2830±15	2860±15	$f_{kl} > f_{mag}$	B

Therefore, different receivers are installed into each radio-frequency unit. The difference of the receivers lies in the wiring of the AFC discriminator stage (valve, 6X6C No.12). If the frequency of the heterodyne is lower than the frequency of the magnetron, then the voltage from the discriminator to the next stage is taken from the eighth pin of the valve; if the frequency of the heterodyne is higher, then the voltage is taken from the fourth pin of the valve. The frequency characteristics of the discriminator for both of these two connection diagrams are with the opposite sign.

While replacing the disabled receiver by a new one from the S.P.T&A. set the above requirements should be observed and in case of inadequacy it is necessary to shift the wire on the valve socket from one pin to the other.

In replacing the receiver the klystron heterodyne should be tuned as follows:

When tuned with the help of a wavemeter:

1. Turn the plunger of the klystron circuit that is screwed out through the front panel of the receiver half way out and look it in this position with a nut.

2. Install the receiver into the radio-frequency unit and out in the receiver-transmitter equipment for the operation mode.

3. Take the frequency of the magnetron generator with the wavemeter of instrument PT-10.

4. Insert the microammeter (100 μA) into the AFC CRYSTAL CURRENT socket of the receiver.

5. Place the ASC - MSC switch of the receiver to the MSC position and tune the klystron up to the maximum reading of the microammeter with the MSC knob.

6. Take the frequency of the klystron heterodyne with the wavemeter of instrument PT-10 by connecting the cable of the wavemeter instead of the cable running from the T-junction of the antenna switch to the signal mixer or to the heterodyne output of the receiver.

7. Determine the frequencies of the magnetron generator and klystron heterodyne following Table No.1.

8. Pull the receiver out of the unit having first disconnected the transmitter equipment by opening the door of this unit. Without touching the plunger in the klystron circuit that is tuned through the receiver panel and without using the MSC knob screw in or out one or

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several plungers in the circle of the klystron circuit (in so doing it should be borne in mind that screwing a plug shortens the wave length of the klystron), lock them with nuts, install the receiver in its place and without cutting in the transmitters measure the wave of the klystron heterodyne again. Repeat this step several times until the frequencies of the klystron and magnetron differ as required by the value close to 30 megacycles.

Notes: 1. While tuning the klystron it should be borne in mind that about 300 volts relative to the chassis of the receiver are applied to the klystron resonator; therefore, a special combination wrench-screw-driver should be used or the receiver should be de-energized prior to turning the plugs.

2. The method of using the wavemeter of instrument PT-10 is described in Para.33 under Measurement of Magnetron Generator Frequency.

When tuned without using the wavemeter:

1. Disconnect the wavemeter and connect all the cables of the receiver and of the antenna switch unit as required for operation.

2. Set the current of the AFC crystal detector equal to 70 - 90 μA. The current is set by the side adjusting screw of the AFC mixer.

3. Turn the ASC - MSC switch to the ASC position. In this case the pointer of the instrument should oscillate slowly without frequency skips of about 1 c.p.s. The smoothness and frequency of oscillations is adjusted by the

SAW-TOOTH VOLTAGE (ПИЛА) adjusting screw located on the front panel of the receiver.

4. Set the transmitter for normal operation. In this case if the klystron is tuned properly, the oscillations of the pointer should settle against the given value (70 - 90 μA). If the tuning of the klystron is not exact, it should be adjusted with a special combination wrench-screw-driver through the hole in the front panel of the receiver until the pointer of the instrument is stopped.

This tuning should be carried out thoroughly by giving half a turn to the adjusting plunger of the klystron cavity resonator and by locking it with a nut each time. When the pointer of the instrument is settled down, it is necessary to obtain the maximum reading of the instrument by tuning the klystron thoroughly. The result of this is that the klystron generation maximum is at the required wave.

5. Insert the oscillograph with the continuous sweep into the AFC PULSE (ИМПУЛЬС АПЧ) test jack of the receiver. In this case the image on the screen of the oscillograph should be somewhat similar to that presented in Fig.34.

6. Place the ASC - MSC switch to the MSC position and slowly turn the MSC potentiometer knob clockwise.

In this case first the negative and then the positive pulses should appear on the screen of the oscillograph as is shown in Fig.35a and b, respectively.

If the pulses appear in the reverse order, it signifies that the klystrons of the 3rd, 4th or 5th channels are adjusted for the frequencies lower than those of the magnetrons (the 1st and 2nd channels are higher than the frequencies of the magnetrons), i.e.

incorrectly and they should be readjusted by 60 megacycles in the corresponding direction.

When the klystron or magnetron are replaced or when the klystron heterodyne is mistuned, it should be tuned in the same way as after the replacement of the receiver. In all cases it is good practice first to try to tune the klystron without the wavemeter, but if it is impossible to tune it in this way, tune it first with the wavemeter and then without the wavemeter.

The heterodyne is coupled to the AFC and signal mixers each time after tuning the klystron heterodyne, after replacement of the germanium detectors as well as when the current is changed in the course of operation.

The coupling should be carried out with the equipment completely energized and after it is warmed up for 15 - 20 minutes in the following order:

(a) insert a microammeter (100 μA) into the SIGNAL (СИГН.) jack of the receiver;

(b) place the ASC - MSC switch of the receiver to the ASC position;

(c) by turning the side adjusting screw of the signal mixer set the current of the signal crystal mixer at 25 - 30 μA by the microammeter;

(d) insert the microammeter into the AFC jack of the receiver;

(e) by turning the side adjusting screw of the AFC mixer set the current of the AFC crystal detector at 60 - 80 μA by the microammeter.

Note: If this fails to set the required value of the crystal detector, the latter should be replaced.

Tuning of the AFC channel mainly resolves itself to correct tuning of the klystron heterodyne. Besides, the following should be done:

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1. By turning the AFC AMPLIFICATION (УСИЛЕН.АПЧ)
adjusting screw to the right as far as it will go set the
maximum amplification of the AFC channel. But if in this
case additional positive pulses unlocking thyratron 14
will be observed on the screen of the oscillograph that is
inserted in the AFC PULSES (ИМПУЛЬСЫ АПЧ) jack (with the
ASC-MSC switch turned to MSC and at any position of
the MSC potentiometer knob), it is necessary to slightly
reduce the amplification of the AFC channel by turning the
AFC AMPLIFICATION adjusting screw until the additional
positive pulses are radically reduced as compared with
the basic positive pulses.(The basic positive pulses are
observed only in one position of the MSC knob.).

<u>Note:</u> If the reduction of amplification of the AFC
does not cause the decrease of the additional
positive pulses, the magnetron should be
replaced.

2. It is necessary to select the optimum coupling
of the AFC mixer loop with the waveguide of the antenna
switch.

To do this insert the oscillograph with the
continuous sweep into the AFC PULSE jack ,turn the ASC - MSC
switch to MSC and set the MSC knob to the position in which
the negative pulses are observed and then having loosened
the locknut in the lower part of the AFC mixer smoothly
move in and out the housing of the mixer until the
maximum value of the pulses is obtained. Then, lock the
nut, place the switch to the ASC position and make sure that:

(a) when the current of the AFC crystal detector is
reduced down to 20 - 25 μA, the AFC is in order, i.e.
the pointer of the instrument does not start to
fluctuate. (The current should be reduced by means of the
side adjusting screw of the AFC mixer);

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(b) with the side adjusting screw of the AFC mixer turned in completely the current of the AFC crystal detector is not less than 95 - 100 μA.

If the requirements given in Items a and b are not observed, replace either the crystal detector in the AFC mixer or the magnetron.

Measurement of the sensitivity of the receivers and tuning of the antenna switches are carried out every day and also:

- after replacement of the signal germanium detector;
- after replacement of one of the dischargers of the antenna switch;
- after replacement of the receiver;
- after replacement of the magnetron or the klystron;
- in case the echo signals are faint or are not observed at all in the given channel;
- after a long interval in operation of the station;
- while starting the station after it is set up at a new position.

The sensitivity of the receivers is measured by instrument PT-10 which should be first warmed up for 10 - 15 min. During the measurement the rear covers of the instrument should be kept open.

The procedure for measuring the sensitivity of the receivers is as follows:

1. Set the receiver-transmitter equipment for normal operation.

2. Check the value of currents in the crystal detectors by the microammeter (100 μA) and the operation of the automatic frequency control.

Leave the AFC-MFC switch in the AFC position.

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3. Insert the microammeter into the DETECTOR (ДЕТЕКТОР) jack of the receiver.

4. Place the LGC-RGC switch of the receiver to the LGC (local gain control) position.

5. Turn the LGC knob to the left as far as it will go (minimum amplification), in this case the microammeter will indicate small current (the zero current of the receiver second detector).

6. Use the adjusting screw of the microammeter to set the pointer at the nearest large division of the scale (0, 10 or 20). This current value of the direct component (0, 10 or 20) should be subtracted from all further readings of the instrument. Thus, the current value of the direct component will be excluded.

7. By turning the LGC knob of the receiver set the noise level of the receiver at 30 μA.

8. Prepare instrument PT-10 for measuring the sensitivity:

(a) place the PULSE - UNDAMPED - MEANDER (ИМПУЛЬС - НЕЗАТУХ. - МЕАНДР) switch to UNDAMPED;

(b) set the LEVEL INDICATOR - POWER METER switch to the LEVEL INDICATOR position;

(c) set the CALIBRATION - MEASUREMENT switch to CALIBRATION;

(d) turn the BALANCE SETTING - READING-ZERO CHECK switch to READING and operate the ZERO SETTING knob to set the pointer of the instrument at zero by using its lower scale;

(e) turn the BALANCE SETTING - READING - ZERO CHECK switch to ZERO CHECK and operate the COARSE or FINE knobs to set the pointer of the instrument at zero by using its lower scale;

(f) turn the BALANCE SETTING - READING - ZERO CHECK switch to BALANCE SETTING and operate the COARSE

or FINE knobs to set the pointer of the instrument at the red line;

(g) turn the CALIBRATION - MEASUREMENT switch to MEASUREMENT and by manipulating the POWER LEVEL SETTING control set the pointer of the instrument at the red line.

Note: Check the instrument for proper balancing as directed above in Points c, d, e, f, g during each retuning and warming up of instrument PT-10.

9. Attach the cable of instrument PT-10 to the connector of the directional coupler in the antenna switch of the unit to be measured.

10. Set instrument PT-10 at 0 - 5 db attenuation.

11. Use the calibration chart of instrument PT-10 to find an approximate frequency value for the receiver to be measured.

12. By turning the frequency tuning control of instrument PT-10 find its frequency at which the pointer of the microammeter will deflect.

Note: Avoid overshooting of the microammeter pointer. For which purpose slowly change the frequency of instrument PT-10 and at any considerable deflection of the microammeter pointer increase the attenuation by instrument PT-10.

13. Tune instrument PT-10 precisely to the frequency of the receiver by the maximum reading of the microammeter, check the level of the output power of instrument PT-10 by its indicator and set such attenuation that the signal from the PT-10 instrument increases the voltage across the detector 1.5 times, i.e. the microammeter should read 45 μA.

Example: According to Item 6 the current of the direct component was set at about 10 μA. Let us set the noise level at 30 μA (Item 7).

In this case the instrument should read $10+30 = 40$ μA.

After the signal is applied from radar tester PT-10, the detector current is increased 1.5 times, i.e. it is equal to 30 μA + 15 μA. In this case the instrument should read $10+30+15 = 55$ μA.

14. By turning the round discharger of the signal mixer of the antenna switch (TR switch) cover the whole range. In this case two or three maximum points will occur. Out of them take the highest maximum.

15. Tune the round side discharger of the antenna switch (ATR tube) by turning it. At this time in different channels the following three cases may occur:

(a) when the adjusting screw is turned smoothly, only one maximum is found; the minimum is far away from the maximum;

(b) when the adjusting screw is turned smoothly, no maximum is found at all or only the minimum is obtained somewhere;

(c) when the adjusting screw is turned smoothly, a sharp minimum is obtained and on its both sides there are two maximums one of which is somewhat higher than the other.

In accordance with this the side discharger (ATR tube) should be tuned in the first case to the maximum, in the second case - by moving aside from the minimum and in the third case - by tuning to the highest of the two maximums.

While tuning the dischargers the generator of instrument PT-10 should be tuned exactly to the frequency of the magnetron, otherwise the dischargers may happen to be tuned to the image frequency, i.e. 60 megacycles aside

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from the correct tuning. The generator frequency of radar tester PT-10 is determined by the chart supplied together with the instrument.

After the generator valve in radar tester PT-10 is replaced, it is necessary to make a new frequency chart of the PT-10 generator. If it is impossible to do so, a new method of tuning the PT-10 instrument to the magnetron frequency is recommended.

For this purpose retune the frequency of the PT-10 generator at a low attenuation of the attenuator in the PT-10 instrument and according to the deflection of the microammeter pointer find the two maximums, noting the readings of the GENERATOR FREQUENCY scale of the PT-10 instrument at each maximum.

Knowing that the readings of the GENERATOR FREQUENCY scale increase with the reduction of frequency it is easy to tell which of the two maximums corresponds to correct tuning. So, the maximum corresponding to the lower of the two readings obtained earlier on the GENERATOR FREQUENCY scales will be correct for channels 1 and 2 (where the frequency of the klystron is lower than that of the magnetron), while the maximum corresponding to the higher readings of the same scale will be correct for channels 3, 4 and 5.

16. When the dischargers are tuned, set the microammeter again at 55 μA by rotating the GENERATOR ATTENUATOR knob of the radar tester.

17. Check the receiver noise level again with the radar tester cut out or mistuned (30 μA) and the signal level with the radar tester cut in and with its frequency tuned exactly (45 μA).

18. Determine the attenuation in decibels by the GENERATOR ATTENUATOR scale of the radar tester.

19. Find the total attenuation value. To do this, sum up the attenuation of the radar tester, the attenuation of its

cable, the attenuation of the directional coupler of the antenna switch and the correction value from the chart supplemented with the radar tester.

The attenuation of the directional coupler is engraved on its front side. The attenuation of the cable, 1 m. long, is equal to 0.7 db (while the attenuation of the cable, 3 m. long is about 1.4 db since the length of one metre is taken into account in tuning the radar tester).

The obtained attenuation value will determine the sensitivity of the receiver when the signal exceeds the noises one and a half times. The sensitivity of the receiver should correspond to the Certificate data and should in all cases be not less than 79 db.

<u>Note:</u> It should be borne in mind that the readings of the GENERATOR ATTENUATOR scales of individual radar testers can differ by several decibels at the same sensitivity. That is why it is best practice to use the testers supplied together with the given station. In this case its sensitivity should not differ greatly from that recorded in the Service log. If it happens so that some other or the repaired tester, or the tester that has already been in service for more than 6 months is to be used, the sensitivity measured by these testers may differ from the Certificate data although the equipment of the station is absolutely sound. In this case it is recommended that the sensitivity of the receiver be measured after the flight test of the station yields satisfactory results and the new data be recorded in the Certificate of the station.

When the adjustment and measurement of the sensitivity has been accomplished, check the receiver for coincidence of

tuning during manual frequency control and during automatic frequency control of the klystron.

The coincidence of tuning of the IFA and AFC is checked by the signals reflected from the ground features.

To scan all the ground features through all the channels use should be made of the antenna tilt in the vertical plane and the following angles should be set:

for the 1st channel from -1° to $+1^{\circ}$;

for the 2nd channel from -1° to -2°;

for the 3rd channel from -2° to -3°;

for the 4th channel from -0° to -2°;

for the 5th channel from -3°.

The procedure for checking the tuning coincidence of the IFA and AFC is as follows:

1. Cut in the oscillograph with the driven sweep, connect its input to the OUTPUT jack of the receiver.
2. Set the receiver-transmitter equipment for normal operation.
3. Tilt the antenna at the required angle.
4. Turn the receiver switches to LGC and ASC.
5. Use the LGC knob to set the receiver amplification level so that the noise occupies 2 - 4 mm on the oscillograph screen.
6. By turning the receiver-transmitter cabin with the manual drive find the signal reflected from the ground feature. In this case it is best practice to choose the most distant ground feature.
7. Compare the pulse values during manual and automatic frequency controls. The values should be the same in both cases.

If they differ, it is necessary to check the tuning of the klystron.

In case of absence or defective operation of the radar tester the dischargers should be tuned by the maximum value of the signal reflected from the ground feature.

In all cases when the receivers are checked and tuned by the reflections from the ground features, the required amplification of the receiver should be kept within such limits that the signal level does not reach the receiver saturation so as to avoid top clipping of the signal.

2. ADJUSTMENT OF INDICATING EQUIPMENT

(37) General

Normally, complete adjustments of the indicators need not be made on the station. Adjusted during operation are mainly the circuits provided with the adjustment controls. The rest of the circuits that may need be adjusted during operation are equipped with the controls combined with the slotted axles brought out to the front panel of the unit. Some of the slotted controls are not brought out to the front panel and are located on the chassis of the instrument. These adjusting screws are resorted to during laboratory tuning of separate circuits.

A number of circuits are of the same design, therefore they are tuned in a similar way. These circuits are as follows:

1. Triggering circuits. After the indicator is cut in, a sweep should be displayed on its screen. If the sweep is not displayed, turn the TRIGGER CUT OFF (ОТСЕЧКА ЗАПУСКА) adjusting screw to the right until the sweep is displayed on the screen. But first check by the range marker unit if the trigger pulse is applied to the indicators.

2. Sweep focusing and brightness circuits. Use the BRIGHTNESS (ЯРКОСТЬ) control to set the normal brightness of the sweep on the indicator screen and focus it at the scale of 400 km. The brightness is set when the echo signals and the markers are cut out. The brightness is considered normal when the range-sweep trace is hardly seen while moving.

3. Echo signal amplification circuits. The amplification of the echo signal channels in the indicators is adjusted after setting the normal brightness and after setting and levelling the noise value at the mixer output.

The amplification of the echo signals is considered normal when the noise background slightly brightens the indicator screen.

4. Marker circuits. When the antenna system is rotated, marker grids including range markers (10-; 50- and 100-km.) and angle markers (5-, 30-degree) will be displayed on the screens of the indicators. The brightness of the marker grids should be so adjusted that they are distinguishable and at the same time do not shadow the image on the screen.

To do this:

(a) use the RANGE MARKER AMPLIFICATION (УСИЛ. ОТМ. ДИСТАНЦИИ) and the AZIMUTH MARKER AMPLIFICATION (УСИЛ.ОТМ. АЗИМУТА) adjusting screws to set the brightness common for the range and azimuth markers;

(b) use the RANGE MARKER CUT OFF (ОТСЕЧКА ОТМ.ДИСТ.) (in the plan position indicator the adjusting screw is substituted by a knob) and the AZIMUTH MARKER CUT OFF (ОТСЕЧКА ОТМ.АЗИМУТА) adjusting screws to choose the relation (convenient for observation) between the

brightness of the 10-, 50- and 100-km, range markers depending on the size of the markers on the indicator and the relation between the brightness of the 5- and 30-degree azimuth markers.

(38) Check of Operation of Indicators

The tuning method that is described below is good only for the sound instrument. As soon as it becomes defective (a valve or some part has become unserviceable or in case of poor contact in one of the circuits, etc.), the image on the indicator screen becomes distorted. The defect is very often located by the image on the screen.

The test jacks on the front panel of the unit are designed for more thorough check of the circuits and for trouble shooting. These jacks may be employed to check voltages in circuits and to obtain the appropriate oscillograms on the oscillographs.

The tables of the test jacks for each unit will be given below. The tables contain the values required for normal operation of the unit.

(39) Adjustment of Range Marker Unit ДА-01

The proper procedure for tuning the range marker unit is as follows:

1. Turn the TEST (КОНТРОЛЬ) switch to the CALIBRATOR DIVISION I (КАЛИБР.I ДЕЛ.) position, the TRIGGER (ЗАПУСК) switch to the MARKER FROM CALIBRATOR (ОТМ.ОТ КАЛИБР.) position and the HORIZONTAL SWEEP switch to FAST.

2. Open the cover of the compartment and set the adjusting screws in the following order:

(a) turn the following knobs to the left all the way through:

TWO KILOMETRE PULSE CUT-OFF (ОТСЕЧКА 2 km.ИМП.), CHECK TRIGGER CUT-OFF (ОТСЕЧКА ЗАП.ПРОВЕРКИ), SYNCHRONIZING PULSE CUT-OFF (ОТСЕЧКА СИНХР. ИМП.), SYNCHRONIZING OF TRIGGER PULSE (СИНХР.ЗАП.ИМП.), MARKER TRIGGER CUT-OFF (ОТСЕЧКА ЗАП.ОТМЕТОК), INDICATOR TRIGGER CUT-OFF (ОТСЕЧКА ЗАП.ИНДИКАТОРОВ), SCALE DELAY (ЗАДЕРЖКА ШКАЛЫ), 10-km. SYNCHRONIZING MARKERS (10 km ОТМЕТКИ СИНХР.), 50-km.SYNCHRONIZING MARKERS, 100-km.SYNCHRONIZING MARKERS, CHECK DURATION (ДЛИТ.ПРОВЕРКИ), CALIBRATOR DIV.I, DIV.II, DIV.III, DIV.IV;

(b) set the following controls in the mid position: LENGTH OF SCALE (ДЛИНА ШКАЛЫ), FOCUS BALANCE (БАЛАНС ФОКУС), COMPENS. OF DAMPING CIRCUIT (КОМПЕНС.ЗАТУХ.К-РА), SETTING OF 10, 50 and 100-km,MARKERS (УСТАНОВКА IO, 50 и 100 km ОТМЕТОК);

(c) turn the SINUSOIDAL AMPLITUDE (АМПЛ.СИНУС.) control to the right all the way through;

(d) during operation the following adjusting screws are not to be turned: 10-km.MARKER, KIPP RELAY (10 km. ОТМЕТКИ КИПП-РЕЛЕ); 50 km. MARKER, KIPP RELAY; 100-km. MARKER, KIPP RELAY; these should remain the position to which they were placed during Manufacturer's adjustment of the unit; if they happen to be misaligned, they should be set in the mid position.

3. Place the SWEEP SHIFT (СДВИГ РАЗВЕРТКИ) knob roughly in the mid position and rotate the BRIGHTNESS knob until a bright spot appears on the screen of the test tube.

4. Turn the CHECK TRIGGER CUT-OFF adjusting screw clockwise until the trace of the horizontal sweep appears on the screen of the test tube. Use the SWEEP SHIFT knob to set the trace in the mid of the screen and manipulate the BRIGHTNESS and FOCUS knobs as well as the FOCUS BALANCE

adjusting screw to set the normal brightness and to focus the sweep.

5. By turning the CALIBR. DIVISION I adjusting screw set frequency division I as is shown in Fig.36, a.

If the required image cannot be obtained due to its unsteadiness it is necessary by changing slightly the position of the CALIBR.DIV.II, CALIBR. DIV. III, and CALIBR. DIV. IV adjusting screws to make the image on the screen of the test tube steady and only then to set the required division of frequency. While tuning the calibrator the brightness of the image on the screen of the test tube is changed very sharply (from very bright to complete disappearance of image), that is why each time it should be adjusted.

6. Place the TEST switch to the CALIBR.DIV.II position and by turning the CALIBR.DIV.II adjusting screw set frequency division II as is shown in Fig.36,b.

7. Place the TEST switch to CALIBR.DIV.III and the HORIZONTAL SWEEP to SLOW. By turning the CALIBR.DIV.III adjusting screw set frequency division III as is shown in Fig.36,c; if the oscillogram is shorter, use the CHECK DURATION adjusting screw to set it as long as in Fig.36, c.

8. Place the TEST switch to CALIBR.DIV.IV and by turning the CALIBR.DIV.IV adjusting screw set frequency division IV as is shown in Fig.36, d.

9. After setting frequency division IV recheck division I, II and III and, if necessary, adjust them so that each frequency division corresponds to the ones shown in figures.

10. Set the TEST switch to AMPLITUDE OF SHOCK-EXCITED CIRCUIT (АМПЛ.УДАРН.К-РА) and turn the MARKER TRIGGER CUT-OFF adjusting screw clockwise until the sine image appears on the screen of the test tube. If the sine amplitude is changed along the length of the sweep,

then by turning the COMPENS. OF DAMPING CIRCUIT adjusting screw make it even throughout the whole length of the sweep as is shown in Fig. 37, b.

Then, by turning the SINUSOIDAL AMPLITUDE adjusting screw counter-clockwise set the amplitude value equal to 10 mm and compensate its dropping with the COMPENS. OF DAMPING CIRCUIT adjusting screw again.

11. Set the HORIZONTAL SWEEP switch to SINE (СИНУС), by turning the SHOCK-EXCITED CIRCUIT FREQUENCY (ЧАСТОТА УДАРН.К-РА) adjusting screw obtain an unblurred contour of ellipse image on the screen of the test tube (Fig.38).

12. Place the HORIZONTAL SWEEP switch to SLOW and the TEST switch to SHOCK-EXCITED CIRCUIT FREQUENCY. Turn the 2-km. PULSE CUT-OFF adjusting screw clockwise until the oscillogram corresponding to that in Fig.39 is displayed on the screen of the tube and then stop just on the verge when the gap in the image becomes filled with pulses while the pulse gap disappears at all (Fig.39,c).

13. Place the TEST switch to MARKERS. By turning the 10-km. MARKERS SETTING adjusting screw set 5 horizontal lines as is shown in Fig.40 and then slowly turn the SYNCHRONIZING PULSE CUT-OFF clockwise until the image becomes distorted (the image starts contracting).

14. Place the TEST switch to MARKER SCALES and the HORIZONTAL SWEEP switch to SINE. Turn the SHOCK-EXCITED CIRCUIT FREQUENCY adjusting screw to obtain a well defined image of the synchronizing pulse with the amplitude of 2 - 3 mm in the middle of the screen as is shown in Fig.41.

By slowly turning the SYNCHR. OF 10-km. MARKERS adjusting screw clockwise obtain the 10-km. range marker pulse (Fig.42) under the synchronizing pulse and then by rotating slowly the SYNCHR. OF 50-km. MARKERS adjusting screw obtain under the 10-km. marker pulse the 50-km. marker pulse that exactly coincides with the 10-km. marker pulse and

whose amplitude is greater. The 10 - and 50-km. marker pulses should be aligned before they become distorted (Fig.43).

15. Set the HORIZONTAL SWEEP switch to SLOW and by turning the 50-km.MARKER SETTING adjusting screw obtain a 50-km. pulse every four 10-km. pulses. The amplitude of the 50-km. pulse on the screen of the test tube should be 20 per cent greater than that of the 10-km. pulse (Fig.44).

16. Turn the HORIZONTAL SWEEP switch to SINE and by rotating the SYNCHR. OF 100-km.MARKERS adjusting screw obtain the 100-km. marker pulse that precisely coincides with the 50-km. marker pulse and whose amplitude is greater (Fig.45). If the 10-, 50- and 100-km. marker pulses are distorted or if they do not coincide, it is necessary to turn slightly the SYNCHR.OF 10-, 50- AND 100-km.MARKERS adjusting screws.

17. Turn the HORIZONTAL SWEEP switch to SLOW and by manipulating the 100-km.MARKERS SETTING adjusting screw obtain the 100-km. marker pulses on every other 50-km.pulse. The amplitude of the 100-km.pulses on the screen of the test tube should be 20 per cent greater than that of the 50-km. pulses (Fig.46).

18. By turning the SCALE LENGTH (ДЛИНА ШКАЛЫ) adjusting screw set the length of the image up to the gap equal to 400 km. (Fig.47).

19. Place the TEST switch to MARKERS and the HORIZONTAL SWEEP switch to SLOW; use the BRIGHTNESS, FOCUS knobs and the BALANCE FOCUS adjusting screw to set the normal brightness and to focus the image. Then,turn the TRIGGER switch to IND.FROM CALIBR.(ИНД.ОТ КАЛИБР.), at this moment the image should disappear from the screen of the test tube.

20. Turn the SYNCHR.OF TRIGGER PULSE adjusting screw clockwise as far as it will go and then rotate the INDICATOR

TRIGGER CUT-OFF adjusting screw clockwise until the original image is displayed on the screen of the test tube.

If in the IND.FROM CALIBR. position of the trigger switch the image on the screen of the tube is considerably distorted, this signifies that the range marker line is not loaded with its characteristic impedance that is located in the plan position indicator repeater at the end of the line. If the characteristic impedance in the above mentioned indicator is available, discontinuity should be looked for in the range marker line from high-frequency connector 1095 in the range marker unit alternately through the plan position indicator, the range and azimuth indicator and the height indicator up to the plan position indicator repeater.

21. Turn the TEST switch to CALIBR.DIV.IV and the TRIGGER switch from IND.FROM CALIBR. to MARKER FROM CALIBR. (Fig.48) and backwards, compare the trigger pulses in both positions of the switch. If in the IND.FROM CALIBR. position the trigger pulse is considerably distorted and its amplitude is far greater than in the other case, this signifies that there is an open circuit in the trigger line or that there is no characteristic impedance in the plan position indicator repeater at the end of the line.

22. Turn the TEST switch to MARKERS, the TRIGGER switch to IND.FROM CALIBR. and the HORIZONTAL SWEEP switch to SLOW, leave the switches in these positions and finish tuning the range marker unit.

23. With the keyer placed in operation turn the TRIGGER switch to the FROM KEYER position.

<u>Note:</u> While switching on all the units of the indicator equipment it may happen that some of the units fail to be triggered due to insufficient amplitude of the trigger pulse from the range marker unit; in this case it is necessary to increase the trigger pulse amplitude by turning the INDICATOR TRIGGER CUT-OFF adjusting screw to the right.

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(40) Adjustment of Azimuth Marker Unit ЖА-50

The proper procedure for adjusting the azimuth marker unit is as follows:

1. Pull the unit out of the cabinet and turn the AMPL. 1500 c.p.s. (АМПЛ.1500 ГЦ) adjusting screw located on the horizontal panel of the unit to the right all the way through and then turn it 1/4 of a revolution backwards.

2. The TRIGGER CUT-OFF adjusting screw is resorted to only in case of doubling of markers (the screw should be turned counter-clockwise) or in case of gaps in the azimuth markers (the screw should be turned clockwise).

3. By turning the LENGTH OF MARKER adjusting screw on the horizontal panel of the unit set the length of the markers equal to the length of the sweep in the plan position indicator, i.e. 400 km.

4. Turn the relation of amplitudes adjusting screw through 180° clockwise.

Distortions and gaps in the azimuth markers will occur with the sweeps of the plan position indicator exceeding 400 km. Turn on the neon lamp of the azimuth marker unit.

Stop the scale of the selsyn repeater at zero, then only the bright 5-degree markers will be displayed on the plan position indicator. Rotate the COARSE ST rotor of the selsyn repeater until bright 5-degree markers appear on the plan position indicator (in the same way as the 30-degree markers). At this time the neon lamp will flash (brightly at each 5-degree marker).

Switch on the reduction unit that rotates the selsyn repeater and if the 30-degree markers are not equally bright, slightly turn the COARSE ST rotor until all 30-degree markers of equal brightness appear on the PPI.

Turn off the neon lamp.

5. Set the RELATION OF AMPLITUDES adjusting screw in the position of the best contrast of markers on the 50-km. scale of the range and azimuth indicator.

(41) Matching and Tuning the Elements of Servo System

The following procedure should be used in matching and tuning the elements of the servo system:

1. Switch on the generator (unit ГА-01) in the receiver-transmitter cabin, energize all the cabinets in the indicator truck, plan position indicator repeater and the armature switches of selsyn, type СЛ-262, in the servo amplifier and the selsyn repeater.

2. Remove the neon lamps from the servo amplifier and selsyn repeater. Turn the adjusting screws located in the compartments of the above-mentioned units as follows: the STAB. CONTR. (РЕГ.УСТОЙЧИВ.) screw all the way through counter-clockwise and the COARSE AND FINE AMPL. (УСИЛ. ТОЧНОГО И ГРУБОГО ОТСЧЕТА) screw all the way through clockwise.

3. Set the rotation speed of the receiver-transmitter cabin at 3 r.p.m. With the cabin rotating, the scales and sweeps in the selsyn repeater, plan position indicator and repeater will also start rotating. If in some unit the sweep rotates counter-clockwise and the scales decrease their values, transpose leads C_1 and C_2 in the fine selsyn of the servomotor unit (БСМ).

If in all the receivers of the plan position indicator and repeater as well as in the selsyn repeater the sweep and the scales are rotated in the opposite direction, transpose leads P_1 and P_2 in the fine selsyn transmitter of the main transmitter unit.

4. If the rotation is proper, insert the neon lamps along the fine tracking channel. With the sweep or the scales in one of the units rotating in the opposite direction,

transpose leads C_1 and C_2 in the coarse selsyn of the corresponding servomotor unit.

If the sweep and the scale on all the units rotate in the opposite direction transpose leads P_1 and P_2 in the coarse selsyn-transmitter of the main transmitter unit.

5. Secure the receiver-transmitter cabin to the trailer. Release the differential lock on the main transmitter unit. By turning the differential roughly set the scales of the selsyn repeater at zero.

(The cabin rotation warning signal may be employed to signal on the moment when the scales of the selsyn repeater coincide with the mark line).

6. Loosen the fastening of the coarse and fine selsyn stators, remove the neon lamp and by turning the fine selsyn stator in either direction accurately zero the fine scale (the coarse scale will be also set at zero) and tighten up the fastening.

7. To check voltage across jack 115 with the oscillograph (or with the voltmeter by the scale of $\sim$ 10 V), turn the coarse selsyn so as to obtain the minimum voltage value. Secure the selsyn and insert the neon lamp.

8. To match the plan position indicator and the plan position indicator repeater units, loosen the fastening of the stator in the coarse and fine selsyns (BCM). If the sweep trace deflects from the North line by more than 10°, by turning the stator of the coarse selsyn in either direction move the sweep trace to the region of the North line (having first matched the start of the sweep with the centre of the graphic scale).

9. Remove the neon lamp and by turning the stator of the fine selsyn impose the sweep on the North line. Secure the selsyn.

10. Make an adjustment as directed in Item 7.

11. If the sweep deflects from the North line by less than $\pm 5^{\circ}$, the adjustment procedure is similar to that for the selsyn repeater described in Items 6 and 7.

12. With the receiver-transmitter cabin rotating and the units properly adjusted, the neon lamps should not burn. If the adjustment is proper but the lamp goes on flashing then give 1/5 of a turn to the COARSE AMPL. adjusting screw counter-clockwise.

13. Stop and secure the transmitter-receiver cabin to the trailer. The scales of the selsyn repeater should be set at zero and the sweep at the North line.

Remove the cover from the main transmitter unit, loosen the screws fastening the scales of the coarse and fine transmitting selsyns, zero the scales and lock them. Put on the cover.

14. Set the speed of the cabin at 6 r.p.m.

15. Set the sector of the range and azimuth indicator so that the sweep crosses its screen when the sweep of the plan position indicator passes along the North line.

16. Do the same on the altitude indicator.

17. Using the ARMATURE (ЯКОРЬ) switch of the СЛ-262 selsyn stop the rotation of the selsyn repeater at the moment when the sweep passes across the screens of the range and azimuth indicators and across the screen of the height indicator.

18. Pull out the selsyn repeater unit and by turning the reduction unit by the drive clutch increase the readings on the scale of the selsyn repeater by 5°.

19. The sweep on the range and azimuth indicator and on the height indicator should be shifted upwards. If the sweep on one of them or on both indicators is shifted downwards, transpose leads C_1 and C_2 in the selsyn of the respective indicator (in the height indicator it is the upper selsyn of the synchro transformer unit).

20. In case leads C_1 and C_2 in the selsyn were transposed, turn on the armature switch of the СЛ-262 selsyn in the selsyn repeater unit and repeat the adjustment procedure described in Items 15, 16 and 17.

21. By turning the reduction unit of the selsyn repeater by the drive clutch zero the scales.

22. Loosen the screws fastening the CHOICE OF SECTOR scale in the range and azimuth indicator.

23. By turning the SECTOR SETTING knob of the range and azimuth indicator obtain the minimum shifting of the sweep when the AZIMUTH SCALE control is turned.

24. With the SECTOR SETTING knob in this position zero the scale and lock it.

25. Do the same on the height indicator. Rotate the VERTICAL SWEEP SCALE knob instead of the AZIMUTH SCALE knob and stop the zero marks on the coarse and fine scales simultaneously. Use the HORIZON LINE SHIFTING control to match the sweep on the height indicator with the lower exponential line of the graphic scale.

26. With the scale of the selsyn repeater stopped a zero increase the brightness of the line on the screen of both the height and the range and azimuth indicators.

27. Turn the ANGLE - AZIMUTH switch to AZIMUTH.

28. Set the selsyn repeater into rotation with the use of the СЛ-262 selsyn switch.

29. Turn on the marker switches both on the height and the range and azimuth indicators.

30. By turning the slotted axle of the FINE ST rotor of the selsyn repeater match one of the 5-degree markers with the zero line on the screens of both the height and the range and azimuth indicators. Tighten up the fastening of the FINE adjusting screw in the selsyn repeater.

31. By turning the slotted axle of the COARSE ST selsyn of the selsyn-repeater match the 30-degree marker with the north (zero) 5-degree marker on the plan position indicator. Tighten up the COARSE ST adjusting screw of the selsyn repeater.

32. Place the switch in the height indicator unit to ANGLE and wait until the marker scale is sufficiently bright (the brightness may be increased).

33. Turn the CHOICE OF SECTOR knob of the height indicator through 1^{o} and watch if the 5-degree markers are shifted vertically. If they shift considerably (about 2^{o}), transpose leads C_1 and C_2 in the 5-degree selsyn of the height indicator (the lower selsyn of the selsyn transformer unit).

34. Loosen the stator of the lower selsyn in the selsyn transformer unit of the height indicator.

35. Zero the scales (both fine and coarse) in the height indicator and see to it that they are not misaligned during further adjustment.

36. By turning manually the stator of the lower selsyn in the selsyn transformer unit of the height indicator match the 5-degree markers in both positions of the ANGLE - AZIMUTH switch. While matching, place the switch alternately to the ANGLE and AZIMUTH positions and observe the 5-degree markers on the screen of the indicator. When the matching is over, turn the switch to ANGLE.

37. While replacing the servo motor units completely or while replacing only their selsyns the corresponding units are adjusted according to these instructions.

38. While replacing the servo motor unit or the selsyns in the selsyn repeater unit it should be completely tuned and matched with the height and the range and azimuth indicators as described above.

While replacing the main transmitter unit (ФД-01) as a whole or its selsyns, apart from the 5-degree marker selsyn transmitter the servo system should be matched in the following order:

(1) Remove the neon lamp from the selsyn repeater unit and turn the receiver-transmitter cabin clockwise. If the scale readings of the selsyn repeater decrease, transpose

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leads P_1 and P_2 in the fine selsyn transmitter of the main transmitter unit.

(2) Insert the neon lamp into the selsyn repeater and set the rotation speed of the transmitter-receiver cabin at 6 r.p.m. If the scale readings of the selsyn repeater decrease, transpose leads P_1 and P_2 in the coarse selsyn transmitter of the main transmitter unit.

(3) Stop the transmitter-receiver cabin. Loosen the stator of the coarse selsyn transmitter in the main transmitter unit and by checking the voltage with the oscillograph (or with the tester, type TT-1, on the scale of ~ 10 V) across jack 115 turn the selsyn so as to reduce the voltage down to the minimum. Then lock the stator.

(4) While replacing the 5-degree marker selsyn-transmitter carry out adjustment as directed in Items 25 - 28, Para.41.

The antenna rotation simulator should be adjusted in the following way:

1. Turn the switch on the antenna rotation simulator to SIMULATION; at this time a red lamp will burn on the unit.

2. Tune this unit in the same way as the main transmitter unit in accordance with Items 1 - 7. Further, instead of rotating the cabin clockwise by means of the manual drive turn the motor clutch by hand in the direction in which it rotates when started and instead of rotating the receiver-transmitter cabin at the speed of 6 r.p.m. set the antenna rotation simulator into rotation.

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(42) Adjustment of Plan Position Indicator II-32

The proper procedure for adjusting the plan position indicator is as follows:

1. Cut in the supply unit of the plan position indicator cabinet.

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2. Turn the DELAY adjusting screw to OFF and the TRIGGER CUT-OFF as well as the DELAY TRIGGER CUT-OFF adjusting screws as far as they will go counter-clockwise; push the CENTRE EXPANSION switch downwards and the FOCUS and BRIGHTNESS knobs roughly in the middle position.

3. Turn the TRIGGER CUT-OFF adjusting screw clockwise until the sweep trace is displayed on the screen of the indicator. If the sweep trace does not appear on the screen, gradually increase the brightness by turning the BRIGHTNESS knob clockwise until the sweep trace is displayed on the screen.

4. Set the ARMATURE switch of the СЛ-262 selsyn in the servo amplifier unit to ON. Turn the AZIMUTH MARKER AMPL. screw and the AZIMUTH MARKER CUT-OFF knob all the way through counter-clockwise.

5. Use the FOCUS and BRIGHTNESS knobs to set normal focusing and brightness of the sweep trace (the brightness is considered normal if the 400-km. sweep trace is hardly seen with the markers and the echo signals cut out).

6. Place the SCALE MARKERS switch to ON, the CENTRE EXPANSION switch to the upper position and the sweep control to the 400-km. position, then using the CENTRE EXPANSION and SECTOR SETTING knobs align the start of the sweep with the centre of the scale.

7. Manipulate the RANGE AMPL. adjusting screws and the RANGE MARKER CUT-OFF knob to set the optimum relation of brightness and range markers.

8. Turn the 400-km. SCALE adjusting screw as far as it will go counter-clockwise and then make ¼ of a turn backwards. Use the SWEEP LENGTH 200 - 400-km. (ДЛИТ. РАЗВЕРТКИ 200 - 400 km.) adjusting screw to set the sweep length corresponding to 400-km.

Manipulate the SWEEP CURRENT adjusting screw and adjust the sweep length so that the 400-km. marker is located closer to the edge.

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9. Place the sweep control to the 200-km. position. Place the ARMATURE switch of the CJ-262 selsyn in the servo amplifier unit to OFF, use the CENTRE EXPANSION and the SECTOR SETTING knobs to shift the start of the sweep towards the edge of the screen so that the sweep passes through the centre of the screen. Turn the ADJUSTMENT OF 200-km. SCALE screw to set the sweep length so that the 400-km. marker is on the other edge of the screen while the 200-km. marker is in the centre.

10. Place the sweep control to the 80 km. position, turn the ADJUSTMENT OF 80-km. SCALE adjusting screw as far as it will go counter-clockwise and use the 80-km. SWEEP LENGTH screw to set the sweep length corresponding to 160 km., then adjust the 80-km. marker scale so that the 80-km. marker is in the centre while the 160-km. marker is at the edge of the screen.

11. Use the CENTRE EXPANSION and the SECTOR SETTING knobs to align the start of the sweep with the centre of the scale and check all the markers. While turning the sweep control the 40-km. marker on the 80-km. scale, the 100-km. marker on the 200-km. scale and the 200-km. marker on the 400-km. scale should coincide. If they fail to coincide, adjust the marker scale of the respective sweep in reference to the 80-km. marker scale. The precise alignment is carried out by manipulating the 200-km. AND 400-km. DELAY adjusting screws at the start of the sweep and the 200-km. and 400-km. SCALES adjusting screw at the end of the sweep when the delay is cut in.

12. Leave the sweep control in the 80-km. position and set the RANGE DELAY knob at zero on the scale. Turn the delay adjusting screw to ON and the TRIGGER CUT-OFF screw all the way through counter-clockwise. Rotate the DELAY TRIGGER CUT-OFF adjusting screw clockwise until the sweep trace is displayed on the screen of the indicator, then disrupt the sweep by turning it counter-clockwise. Turn the TRIGGER CUT-OFF adjusting screw until the sweep is displayed on the screen.

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Slowly rotate the RANGE DELAY knob counter-clockwise from 0 to 320. In this case all the range markers should shift smoothly from the edge to the centre of the screen.

If the sweep disappears from the screen of the indicator at the beginning or on separate sections of the scale, adjust the DELAY TRIGGER CUT-OFF and the TRIGGER CUT-OFF screws again.

13. Check the delay setting on the scale against the actual range delay on the screen of the indicator every 50 km.; if the error exceeds ±10 km., adjust the minimum and maximum limits of the delay by using the corresponding adjusting screws on the upper panel inside the unit.

14. Turn the sweep control to the 400-km. position and switch on the rotation drive. Adjust the brightness of the 5- and 30-degree markers by means of the AZIMUTH MARKER AMPL. and the AZIMUTH MARKER CUT-OFF SCREWS.

(43) Adjustment of Range and Azimuth Indicator (BO-01)

The proper procedure for adjusting the range and azimuth indicator is as follows:

1. Cut in the supply unit of the indicator cabinet.

2. Pull out the selsyn repeater. Place the ARMATURE switch to OFF. By turning the reduction unit by the drive clutch set the fine and coarse scales exactly at zero.

3. Use the SECTOR SETTING knob on the front panel of the unit to set the scale close to zero.

4. Place the sweep control to the 100-km. position, the DELAY switch (on the front panel inside the unit) to OFF and turn the TRIGGER CUT-OFF, DELAY TRIGGER CUT-OFF, AZIMUTH MARKERS CUT-OFF and the AZIMUTH MARKER AMPL. adjusting screws as far as they will go counter-clockwise.

5. Rotate the TRIGGER CUT-OFF screw clockwise until a horizontal sweep trace is displayed on the screen of the

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indicator. If the sweep does not appear, gradually increase the brightness (and at the same time adjust the trigger cut-off) until the sweep trace is displayed on the screen.

6. Use the HORIZONTAL SHIFT screw to set the start of the sweep near the left edge of the screen.

7. Turn the SCALE OF 100 km. adjusting screw all the way through counter-clockwise and then make ¼ of a turn backwards. Use the 100-km. SWEEP LENGTH screw to set the length corresponding to 120 km. and then manipulate the SWEEP CURRENT screw to set the sweep length so that the screen covers 100 km.

8. Place the sweep control to the 50 km. position, turn the SCALE OF 50-km. adjusting screw as far as it will go counter-clockwise and use the SWEEP LENGTH screw to set the length corresponding to 60 km. and then use the SCALE OF 50-km. adjusting screw to set the sweep length so that the screen COVERS 50 km.

9. Set the DELAY switch to ON and turn the TRIGGER CUT-OFF screw counter-clockwise all the way through. Rotate the DELAY TRIGGER CUT-OFF adjusting screw until a steady sweep trace is displayed on the screen of the indicator; then, by turning it counter-clockwise disrupt the sweep. Rotate the TRIGGER CUT-OFF adjusting screw until the sweep is displayed. Slowly turn the RANGE SETTING knob counter-clockwise from 0 to 3.20. At this time all the range markers should move smoothly from one edge of the screen to the other.

If the sweep is disrupted on separate sections, adjust the trigger cut-off and the delay trigger cut-off more accurately.

10. Check to see that the readings of the range scale coincide with the position of the corresponding range markers relative to the centre of the screen every 50 km. If the error exceeds ±10 km. adjust the minimum and the maximum delay limits by means of the respective adjusting screws on the upper panel inside the unit.

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11. Use the VERTICAL SHIFT adjusting screw to set the sweep just in the centre of the screen.

12. Turn the SECTOR SETTING knob through 30° clockwise or counter-clockwise from zero; the sweep trace should be shifted in this case by 5 mm below the upper or above the lower edge of the screen.

If the misalignment of the upper and lower settings is considerable, remove it by operating the RESOLVER BIAS (СМЕЩЕНИЕ РЕЗОЛЬВЕРА) adjusting screw.

13. Accurately zero the SECTOR SETTING scale and set the selsyn repeater into rotation.

Use the AZIMUTH MARKER knob to adjust the markers so that somewhat more than 60° are displayed on the screen (30-degree azimuth markers should be observed on the top and on the bottom of the screen).

14. Use the UPPER BLANK. LEVEL and the LOWER BLANK. LEVEL screws to adjust the blanking device for operating beyond the limits of the working sector of 60°.

(44) Adjustment of Height Indicator HO-02

The proper procedure for adjusting the height indicator is as follows:

1. Cut in the supply unit of the height indicator cabinet.

2. Pull out the selsyn repeater. Throw the ARMATURE control to OFF. Turning the reduction unit by the drive clutch accurately zero the coarse and fine scales.

3. Zero the scales by the SECTOR SETTING knob (on the front panel of the height indicator).

4. Turn the TRIGGER CUT-OFF, ANGLE MARKER CUT-OFF and ANGLE MARKER AMPL. adjusting screws all the way through counter-clockwise.

5. Turn the TRIGGER CUT-OFF screw clockwise until a steady sweep line is displayed on the screen of the indicator.

If the sweep does not appear, gradually increase the brightness simultaneously adjusting the trigger cut-off) until the sweep trace is displayed.

6. Turn the HORIZONTAL SWEEP SCALE adjusting screw all the way through counter-clockwise and then make ¼ of a turn backwards; use the LENGTH OF HORIZONTAL SWEEP screw to set the length of the horizontal sweep corresponding to 300 km. and use the HORIZONTAL CURRENT screw to set the sweep length so that the whole screen covers 200 km.

7. Manipulate the VERTICAL SHIFT and HORIZONTAL SHIFT adjusting screws to align the start of the horizontal sweep (lower left corner) with the beginning of the graphic scale, then use the VERTICAL SWEEP RATE and the VERTICAL SWEEP AMPL. knobs to match the markers with the graphic scale. The initial tilt of the exponential is adjusted by the VERTICAL SWEEP RATE knob and the end of the exponential is adjusted by the VERTICAL SWEEP AMPL. knob.

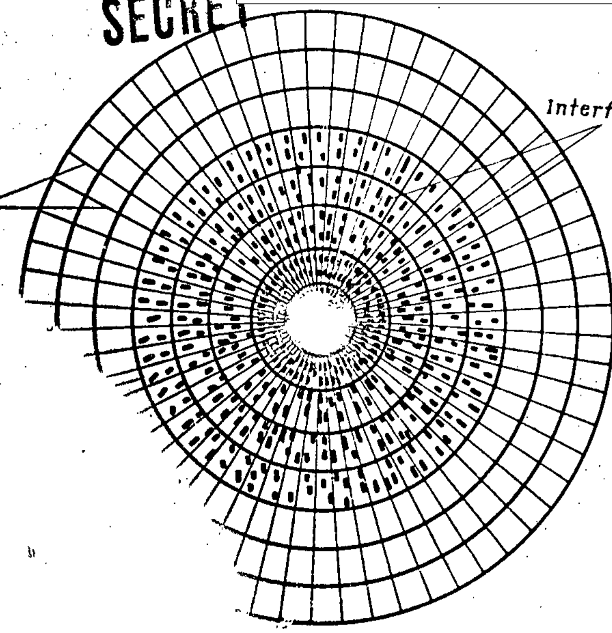
8. Set the scales at 350° by the SECTOR SETTING knob and align the sweep with the second exponential of the graphic scale by means of the VERTICAL SWEEP SCALE knob and the VERTICAL SWEEP CURRENT adjusting screw.

9. Set the selsyn repeater into rotation.

10. Use the CONTINUOUS BRIGHTENING screw to set the upper limit of the vertical sweep within the screen of the tube. Set the operation angle for the blanking device equal to 45° by the LOWER BLANKING LEVEL and the UPPER BLANKING LEVEL adjusting screws. The screen of the indicator should cover 9 lines of the 5-degree azimuth markers. The lower line should be horizontal and during rotation it should be observed for a very short period of time.

11. Turn the MARKERS (ANGLE-AZIMUTH) screw to ANGLE.

12. Feed the noise from the mixer only through the vertical beam channel. Increase the brightness of the noise on the



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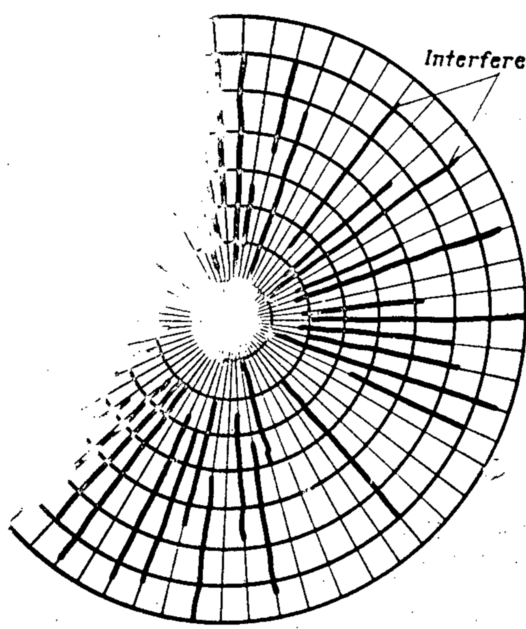

F i g. 51. Interference Display on Plan Position Indicator Screen Due to Circuit Breakers Sparking

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screen with the VERTICAL ECHO AMPLIFICATION (УСИЛЕНИЕ ВЕР ЭХО) screw. Use the channel change-over screw to set t noise limit in the middle between the second and th 5-degree markers (7.5°).

(45) Adjustment of Antenna Turn Angle Mark

The antenna turn angle marker unit is height indicator and is fed from the supp through the height indicator.

The adjustment of this unit should the following way:

1. Open the cover of the unit co ANGLE ACCURACY and the TRIGGER CUT-OI far as they will go counter-clockwis

2. Turn the SYNCHR. CUT-OFF and as far as they will go clockwise and adjusting screw in the middle positi

3. Rotate the TRIGGER CUT-OFF s until a line of almost continuous a on the screen of the height indicato

4. Turn the ANGLE PULSE screw co the angle marker lines disappear from height indicator, If the angle markers the screen readjust the TRIGGER CUT-OFF s in Item 3.

5. Turn the ANGLE ACCURACY screw clockwis 5-degree angle markers are displayed on the scr any gaps.

6. By turning the MARKER LENGTH adjusting scr the length of the angle marker corresponding to the of the horizontal sweep of the height indicator, i.e.,

All these steps having been accomplished, finish the tuning of the unit.

(46) Adjustment of Mixer СБ-50

To adjust the mixer:

1. Throw the TRIGGER switch on the right side of the unit to ON.

2. Turn the OSCILLOGRAPH AMPL. (УСИЛЕН.ОСЦИЛЛ.) screw as far as it will go counter-clockwise.

3. Check the unit for presence of blanking pulse BEGINNING in the BLANKING PULSES (MIDDLE and LOWER) positions of the master switch and set the required length of these blanking pulses corresponding to 25 - 45 km. by means of the respective adjusting screw (on the right side of the front panel).

4. Throw the TRIGGER switch to OFF.

5. Set the master switch to CALIBRATION.

6. Use the OSCILLOGRAPH AMPL. screw of the oscillograph to set the amplitude of the calibration voltage at 10 mm when the channel change-over switch is turned to VERT.

7. Throw the receiver switches to OFF.

8. Turn the master switch to the OUTPUT PRIOR TO CUT-OFF (ВЫХОД ДО ОТСЕЧКИ) position. Turn the OVERALL GAIN knob of the vertical beam gain and the OVERALL GAIN (ОБЩЕЕ УСИЛЕНИЕ) knob of the slant beam gain as far as they will go clockwise. Throw the switch of the oscillograph to VERT.

9. Use the compensation adjusting screws (on the chassis inside the unit) to set the noise level at the maximum on the screen of the oscillograph.

At this time each receiver is cut in separately and the compensation potentiometer of this receiver is turned until the noise amplitude on the oscillograph screen is reduced.

10. Place the oscillograph switch to SLANT and by rotating alternately the compensation adjusting screws of the slant beam perform the compensation as instructed in Item 9.

11. Switch on all the receivers.

12. Throw the OSCILLOGRAPH CHANGE-OVER (ПЕРЕКЛ.КОНТР. ОСЦИЛ.) switch to the VERT. position.

By operating the amplification adjusting screws of the receiver and with reference to the oscillograhp set the noise band equal to one fourth of the calibration voltage (0.5 V) for each position of the master switch: UPPER, MIDDLE and LOWER INPUTS.

13. Throw the OSCILLOGRAPH CHANGE-OVER switch to SLANT (НАКЛ.) and in each position INPUT (UPPER and LOWER) of the master switch set the noise level equal to 0.5 V.

14. Set the master switch to the OUTPUT PRIOR TO CUT-OFF position and using the channel change-over controls of the slant and vertical beams set the noise level for both channels equal to 2 - 3 V; then, cut out all the receivers and by energizing them in turn check the receivers for equal noise.

15. Throw the master switch to the CHANNELS OUTPUT position, the OSCILLOGRAPH CHANGE-OVER switch to VERT. and set the noise level at 0.5 V by the OUTPUT CUT-OFF adjusting screw.

16. Place the OSCILLOGRAPH CHANGE-OVER switch to SLANT and set the noise level at 0.5 V by the OUTPUT CUT-OFF screw.

17. To tune the selector, turn the master switch to the CHANNELS OUTPUT, the SELECTOR-OFF OUTPUT (ВЫХОД БЕЗ СЕЛЕКТОРА) switch to OFF, the SELECTOR switch to ON and rotate the SELECTOR INPUT CUT-OFF (ОТСЕЧКА ВХОДА СЕЛЕКТОРА) adjusting screw clockwise until separate noise blips appear on the screen of the plan position indicator on each channel in turn.

(47) Adjustment of Selsyn Repeater XA-01

To adjust the selsyn repeater:

1. Cut in the supply unit of the marker cabinet.
2. Secure the receiver-transmitter cabin with the travelling lock.
3. Pull the selsyn repeater out of the cabinet compartment.

4. Insert the oscillograph into jack 115.

5. Turn on the ARMATURE СЛ-262 switch in the compartment of the selsyn repeater unit; in this case the system will be synchronized; note the position of scales in the unit.

6. Turn off the ARMATURE СЛ-262 switch.

7. Rotate the driving clutch of the servomotor unit (БСМ-02) in either direction from the noted position to make sure that the voltage across jack 115 is at the minimum, i.e. any turn of the clutch increases the voltage. If the minimum voltage is obtained aside from the noted position of the scale, then it is necessary to:

(a) cut in the armature of the СЛ-262 selsyn;

(b) remove the neon lamp;

(c) loosen the screws holding the stator of the coarse selsyn in the servomotor unit (БСМ-02);

(d) turn the stator of the coarse selsyn so as to decrease the voltage and check it by means of the oscillograph. On obtaining the minimum voltage value secure the selsyn stator.

8. Insert the neon lamp.

9. Turn the FINE AMPL. and the COARSE AMPL. adjusting screws as far as they will go clockwise and the STABILITY CONTROL (РЕГУЛ.УСТОЙЧИВ.) screw as far as it will go counter-clockwise.

10. Cut out the СЛ-262 armature and after eliminating the play turn the driving clutch in any direction through two divisions on the fine scale from the position when the armature is cut out.

11. Connect the oscillograph to jack 91 and by manipulating the oscillograph gain control set such a voltage that the display covers ¾ of the screen of the cathode-ray tube and during further measurements do not change the gain control of the oscillograph.

12. The obtained value of the error voltage across jac will correspond to the error angle of 12 minutes and wil considered as a reference one.

13. Unlock the transmitter-receiver cabin.

14. Set the cabin into rotation.

15. Turn on the СЛ-262 ARMATURE switch.

16. The relation of the voltage across jack reference voltage will determine the error of system, i.e. if the voltage of the system is as the reference voltage, the following erro to 6 minutes.

17. Checking the voltage across jack ✓ lograph rotate the STABILITY adjusting scr until the minimum error voltage is obtainc responds to the minimum following error.

18. Turn off the СЛ-262 ARMATURE s

19. Cut out the 1500 c.p.s. generato

20. Turn the COARSE AMPL. screw count until the neon lamp goes out.

21. Turn on the СЛ-262 ARMATURE sw

22. If the system starts rotating, tu adjusting screw counter-clockwise until the rotating. If this screw fails to stop the rot system, adjust the STABILITY adjusting screw.

<u>Note:</u> After carrying out the adjustment opera described in Items 19, 20, 21 and 22 the fo lowing error can be increased (within the tolerance limits up to 6 min) as a result of th decreased amplification in the fine reading stage.

(48) <u>Adjustment of Servo Amplifier Unit УС-02</u>

To adjust the servo amplifier:

1. Cut in the supply unit of the plan position indicator cabinet.

2. Secure the receiver-transmitter cabin with the travelling lock.

3. Turn on the СЛ-262 ARMATURE switch.

4. Connect the oscillograph to jack No.115.

5. Remove the neon lamp.

6. Turn off the СЛ-262 ARMATURE switch.

7. Note the readings on the scales of the main transmitter unit and by turning the differential of the main transmitter unit in either direction make sure that the voltage across jack 115 is at the minimum, i.e. that the voltage will be increased with every turn of the differential. If the minimum voltage can be obtained aside from the noted position of the scales of the main transmitter unit, then proceed as follows:

(a) set the scales in the former position;

(b) insert the neon lamp;

(c) put on the СЛ-262 ARMATURE switch and the system should be matched;

(d) loosen the screws holding the stator of the coarse selsyn in the servomotor unit БСМ-01;

(e) remove the neon lamp;

(f) checking the voltage across jack 115 against the oscillograph turn the selsyn so as to decrease the voltage. Having obtained the minimum value secure the selsyn.

8. Insert the neon lamp.

9. Turn the FINE AMPL. and COARSE AMPL. adjusting screws as far as they will go clockwise and the STABILITY screw all the way counter-clockwise.

10. Unlock the receiver-transmitter cabin and set in into rotation.

11. Check the following error across jack 91 of the servo amplifier unit by means of the scale determined by the selsyn repeater unit (Items 15, 16, 17, Para. 47).

12. Adjust the COARSE AMPL., FINE AMPL. and the STABILITY adjusting screws as instructed in Items 18, 19, 20, 21 and 22, Para. 47.

(49) Adjustment of Supply Units БП-01 and БП-02

The adjustment of the supply units is carried out in those cases when the equipment that operates with these units shows signs of malfunctioning.

During adjustment use is made of the adjusting screws located in the compartment of the unit. Using the tester, type TT-1, with a jack plug, set the value of 3 V at 171-02 by turning +300 V CONTROL (PEГ. +300В) adjusting screw which corresponds to +300 V at the output of the unit. In the supply unit БП-01, apart from the +300 V adjusting screw, the +5.5 kV adjusting screw should be also regulated. The voltage is checked across jack 170-04 and should correspond to 2 V.

Chapter V

TROUBLE SHOOTING

I. TROUBLES IN RECEIVER-TRANSMITTER EQUIPMENT

(50) Troubles and Remedies, Receiver Channel

In case of any trouble in the receiver channel it is necessary first of all to sectionalize it and then to localize the fault. For rapid location of troubles, apart from the key diagram, use should be made of the Voltage and Resistance Tables given in Appendix 1.

It should be born in mind that most often faulty vacuum parts render the system unserviceable.

If the resistors, capacitors or other parts in the receiver circuit are out of repair, they should be replaced very carefully so that the arrangement of the parts and the length of the connecting conductors are not changed. Otherwise, this may result in mistuning of the receiver. Do not tune the I.F. amplifier and AFC circuits in the field.

Note: While measuring the operating voltages of the I.F. amplifier valve, the control grid of valve 4 should be earthed (to avoid excitation of the I.F. amplifier strip).

The anode voltages fed to the valves from bus +300 V are measured at the minimum noise voltage (the valve basing is given in Appendix I, B).

To measure the operating voltages of the valves, remove the receiver from the cabinet and connect it to the receiver supply unit included in the SPT& A set.

(51) Replacement of Klystron

To replace the klystron:

1. Remove the valve holder from the klystron base.

2. Remove the contact cap from the klystron repeller electrode.

3. Disconnect the high-voltage conductor from the body of the cavity resonator.

4. Loosen two screws on the insulation lugs of the cavity resonator and carefully shift the resonator with the klystron so that the screws go out of the slots. Then, the klystron can be taken out of the receiver and the cavity resonator can be removed from it.

5. To disassemble the resonator, loosen the screws holding the clamping rings and turn the rings to match the round holes and then remove the rings.

The assembly of the resonator and the installation of the klystron are carried out in the reverse order.

After mounting the klystron in place check to see if the contact cap is put on the klystron repeller electrode lead since the absence of the cap with the lead from the repeller electrode may render the klystron unserviceable.

(52) Replacement of Dischargers

While replacing the side discharger loosen two special knurled nuts with a flat wrench, then remove one of them by hand and retaining the hold of the external section of the chamber with one hand remove the other nut; whereupon, separate the external section of the chamber and the discharger.

The discharger is equipped with thin and wide clamping rings (two rings on each side). The rings should be removed from the discharger.

A new side discharger is mounted in the reverse order. The discharger should be installed into the stationary section so that its flexible cheeks rest against the exterior surfaces of the chamber guides. It is good practice to turn the discharger around its axis so that the cheeks are parallel all th way round.

Then it is necessary to couple the detachable section of the chamber with its stationary part paying special attention to the fact that they are coupled along the guide pins. Thereupon, put on the clamping rings. See to it that the convex taper section of the ring faces the metal cheeks of the discharger. The wide rings are put after the thin ones and then both nuts are manually screwed on and tightened up with the wrench right home in order to make the contact reliable.

The main discharger is replaced in the same way as the side one, the only difference being that the role of the second nut is fulfilled here by a special concentric tube. Prior to removing this tube take off the high voltage connector that supplies the ignition voltage to the discharger. The tube is screwed off manually. The tube should be mounted in such a way that the lead of the ignition electrode of the discharger fits the spring contact of the tube.

To replace the electrodeless discharger, drive the four screws passing through the coupling flanges all the way out by means of a screw-driver or a wrench. Then, separate the radio-frequency head of the receiver from the antenna switch and remove the discharger from the recess.

In mounting a new discharger special attention should be paid to the fact that it is fitted with the rectangular clamping springs. While driving the bolts see to it that they are tightened up uniformly in a criss-cross manner.

The electrodeless dischargers mounted in different channels should be of the following types: type PP-2 for channels 1 and 3, type PP-24 for channel 2, type PP-3 for channel 5 and type PP-20 for channel 4.

(53) Replacement of Germanium Detectors

To replace the detector, drive out the union nut of the connector of the mixer cable, drive a special device or the screw with the 3-mm thread into the detector holder and carefully remove the holder together with the detector. Then, drive the detector and the device out of the holder. Drive a new detector into the holder, install it into the mixer compartment and tighten up the nut of the cable connector. While mounting a new detector special attention should be paid to the fact that it fits into the compartment without misalignment.

After the detector of the signal mixer is replaced, check the current value of this detector and measure its sensitivity.

To obtain the maximum sensitivity, choose the detectors for each channel, bearing in mind that the detector which does not ensure high sensitivity in one channel can ensure it in the other.

The detector that do not ensure high sensitivity at all should be used in the AFC mixer; the operation of the AFC circuit being checked each time after the replacement of the detector.

(54) Probable Troubles in Receiver Channel of Station

Trouble	Remedy
1. All voltages not available, signal lamp in echo signal receiver burning while signal lamp in receiver supply unit dead.	1. Replace fuse 30 in receiver supply unit.

Detectors

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special device or the
detector holder and
with the detector, the
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igh sensitivity at
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the replacement of

in Receiver Channel
ion

Remedy
1. Replace fuse 30 ... ceiver supply unit.

Trouble	Remedy
2. No voltage in -225 V circuit.	2. Replace kenotron 3 (5Ц4С) in receiver supply unit.
3. No voltage in +105 V circuit.	3. Replace control valve 22 (6П3С) in echo signal receiver and then use adjusting screw of potentiometer 95 that is located in main panel of receiver to set voltage according to Tables in Appendix I, A.
4. Voltage +105 V differs from standard level considerably.	4. (a) replace valve 23 (6Ж4); (b) set the required voltage with adjusting screw 95; (c) check circuit breaker 34 in radio frequency unit ША-02 for proper functioning.
5. Noise level of detector load at maximum amplification is below normal limit of -1.5 V (it is checked by microammeter 100 μA inserted into DETECTOR jack. Deflection of pointer 50 divisions correspond to noise level of 1.5 V).	5. In early receivers: x)(a) replace alternately valves 9, 8, 7, 6, 5, 4, 3, 1 of the I.F. amplifier stages by valve 6Ж8П known to be sound; (b) measure voltage in +105 V circuit.

x) In recent receivers valves 1-9 are of type 6Ж1П.

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Trouble	Remedy
	Second stage is fitted with valve 6Н15П. Do not insert valve 6Ж3П there since it may cause burning of resistor 30 and reduction of sensitivity by 6 - 8 db.; (c) replace valve 2(6Н15П).
6. No noise on detector load.	6. (a) replace valve 16 (6Н9С) in IAGC stage; (b) check valves 1-9 in I.F. amplifier stages for proper functioning; (c) inspect resistors and capacitors in I.F. amplifier stages then measure operating voltages or resistance of seperate sections of circuit; (d) remove sticking of all three contacts in relay 242 (IAGC).
7. No noise across receiver output. It is checked by connecting oscillograph to OUTPUT jack in echo signal receiver.	7. (a) replace valve 10 (6Ж4); (b) replace valve 18 (6П3С).
8. No current across both SIGNAL and AFC jacks of crystal detectors.	8.(a) replace klystron 19 (K-11); (b) check contacts in cable connectors 1039 of echo signal receiver and in middle connector of antenna switch tee-joint (1207).

Trouble	Remedy
9. No current or low current on one of crystal detectors.	9.(a) replace crystal detector; (b) check cable connectors 1268-1269 (or 1270-1271); (c) check resistance between central contact of cable connector 1269 (or 1271) and mixer body for which purpose drive coupling adjusting screw all way out. Resistance should vary within 40 - 60 ohms. Resistance value may be changed by tightening and loosening nut at mixer connector or by replacing washers with graphite.
10. Faulty saw-tooth voltage stage of slow sweep in AFC circuit.	10.(a) replace valve 15 (TT1-01/0.3); (b) check resistors 71 and 72.
11. Faulty AFC circuit (when transmitter equipment is put on, fluctuations of pointer in microammeter connected to AFC CRYSTAL CURRENT jack do not cease with klystron adjustment known to be proper).	11. A. Use oscillograph to check presence of positive and negative pulses, for which purpose connect oscillograph with continuous sweep to AFC PULSES jack, place ASC-MSC switch to MSC and turn MSC potentiometer smoothly. In this case: (a) if positive and negative pulses are not fed, replace valves 11, 12, 13;

Trouble	Remedy
	(b) if only positive or negative pulses are not fed, replace valve 12 (6X6C); (c) if positive pulses do not differ in the form from negative ones (not thicker at the end), replace thyratron 14 (TF1-0.1/0.3). B. Replace detector in AFC detector. C. Replace magnetron.
12. At the moment of switching on transmitting equipment current of AFC crystal detector disappears, positive pulses are displayed on oscillograph in any position of MSC oscillograph.	12.(a) Use AFC AMPL. potentiometer to reduce amplifications; (b) replace magnetron.
13. Sensitivity of receiver channel is sharply reduced by more than 2 - 3 db.).	13. Measure sensitivity with transmitter off. To do this, after measuring sensitivity with transmitter on, do not change position of GENERATOR FREQUENCY knob in radar tester, type PT-10, cut out transmitter and throw MSC-ASC switch to MSC. Open antenna switch gate. Then, rotating MSC knob try to obtain maximum deflection of pointer in microammeter inserted in DETECTOR monitoring jack.

14. Any re
control fails
no noise acro
input.

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Trouble	Remedy
	Measure sensitivity in the same way as when transmitter is out in. Difference in sensitivity values should be not more than 1 db. Do not carry out this check in cloudy weather since clouds are reflected on screen. During check transmitter-receiver cabin should be directed to the side free from ground clutter. A. If difference in measurements is far greater than 1 db, replace discharger PP-2 (PP-3, PP-4, PP-20). B. If difference is less than 1 db but sensitivity value is below certificate value: (a) replace detector in signal mixer; (b) replace valves 1 and 2 in echo signal receiver; (c) check dischargers, type PP-7, for proper functioning and installation.
14. Any remote control fails to operate, no noise across mixer input.	14.(a) Check cables connecting trucks 1 and 2 for evidence of open circuit; (b) check mixer for proper functioning.

(55) Troubles in Transmitter Units

1. Absence of glow in the spark-gaps of the antenna switch signifies that the magnetron is out of order. In this case the protective thermorelay will operate and the unit will be cut out. It may happen that oscillation takes place, but the thermorelay cuts out the unit. In this case the replacement of the magnetron is imperative.

2. Do not set the anode current at full range when a new magnetron is just installed.

Age the magnetron for 2 - 4 hours at the low anode current (10 - 15 mA) when the magnetron is not punctured and then gradually increase the current up to the standard level.

3. The magnetron punctures are characterized by sharp chaotic indications of the anode current milliammeter. If the aging does not yield the required results, replace the magnetron.

Note: The aging of the magnetron is also necessary after a long interval in the operation of the station (for several months).

4. The reduced noise in the receiver, overheating of the fan motors and interference on the oscillograph indicate to poor connection in the power contacts of the unit circuit breaker ША-34. In this case the receiver may fail to operate at all or will operate but badly. The check consists in measuring the voltage across the output contacts of the circuit breaker. The ШУ-19 switch on the local control cabinet should be placed to BLOWING.

(56) Replacement of Magnetrons

The replacement procedure for magnetrons is as follows:

1. Open the radio frequency unit cabinet.

2. Remove the contact connections from the magnetron filament leads.

3. Loosen two nuts on the bolts holding the magnetron coupling and the louvred waveguide and turn the bolts so that their lugs are opposite the slots in the flange of the magnetron coupling.

4. Pull the spring loaded pin on the left side of the magnetron assembly and pull the handle back.

5. Pull back the bracket supporting the magnetron.

6. Screw off the magnetron clamping nut with a special wrench and remove the magnetron.

Depending on the friction the brass cylinder that connects the internal conductor of the magnetron coaxial line with the exciter will remain either in the coaxial line or in the exciter. The cylinder should be removed and mounted on the new magnetron.

7. To install a new magnetron, reverse the above procedure.

While mounting a new magnetron see to it that both coaxial lines are aligned. Do not exert excessive effort, otherwise this may cause breakage of the glass and damage to the magnetron. While placing the magnetron into the cabinet avoid any considerable friction of the magnetron panels against the head-pieces of the magnet.

(57) Replacement of Electrodes in Rotary Spark-Gap

During operation of the rotary spark-gap its electrodes are gradually worn out, therefore they should be always inspected and, if necessary, changed.

The fixed electrode is worn out most excessively. It should be replaced in case of sputtering that causes irregular puncturing (which is heard); or in case the size of the operating portion of the electrode is reduced by 20 - 25 per cent after 300 - 500 operating hours.

To increase the service life of the fixed electrode that has the form of a rod, turn it through 120° in the collet after its operating portion is worn out. As soon as this portion is also worn out, turn the electrode through 120° again. With the electrode being worn out on all the three sides, take it out of the collet and insert the worn end of the rod into the collet. After this end is also worn out, replace the electrode by a new one. Each time when the position of the electrode is changed or when the electrode is replaced, the discharge phase should be checked and, if necessary, adjusted.

The cases when the removable electrodes are replaced are the same and their service life is 2000 - 3000 operating hours.

The electrodes are replaced by means of two wrenches. One of them is used for holding the electrode in its initial position, the other one for unscrewing the respective clamping nut. While replacing the removable electrodes special attention should be paid to the fact that the guide pin enters the respective slot in the disc.

1. PRIOR TO REPLACING OR INSPECTING THE ELECTRODES OF THE SPARK-GAP DE-ENERGIZE THE TRANSMITTING CABIN IN ORDER TO AVOID INADVERTENT SWITCHING WHICH MAY CAUSE ACCIDENTS.

IT IS BEST PRACTICE TO DE-ENERGIZE THE LINE THAT FEEDS THE INCREASED FREQUENCY MOTOR-GENERATOR SET BY CUTTING OUT CONNECTOR 1167 ON THE CABLE BOX.

2. THE SPARK OF THE SPARK-GAP SHOULD BE OBSERVED DURING OPERATION THROUGH SMOKED GLASS OR ANY OTHER LIGHT FILTER THAT ABSORBS ULTRAVIOLET RADIATION AND REDUCES THE BRIGHTNESS.

(58) Equipment Troubles Causing Noise on Indicator Screens

In cases of improper adjustment or troubles in the receiver-transmitter equipment the screens of the indicators may be subjected to the noise interfering with the normal observation. The noise may be caused:

- by wrong setting of the discharge phase of the spark-gap;
- by poor contact between the brushes and rings of the rotary joint;
- by poor contact in the circuit breakers and relays (including the centrifugal relay);
- by bad grinding of the brushes or dirt on the ring of the increased frequency motor-generator set;
- by puncture in the magnetrons and the waveguide channel and burning of the detectors in the signal mixers;
- by poor contacts in all connectors and detector jacks.

Noise caused by wrong setting of discharge phase is observed on the screen of the plan position indicator as bright chaotic spots round the whole circle of from 40 to 60 km. in radius. Usually this noise is observed in all five channels. If the noise appears during operation, it is caused by a change of frequency of the supply circuit. In this case it is necessary to set the former frequency of the supply circuit (50±0.5 c.p.s.) or to readjust the discharge phases.

If the discharge phase was set wrongly at the very beginning, the noise will appear immediately after cutting in.

While observing the discharge phase on the oscillograph the characteristic feature of the noise will consists in the gaps appearing in the line following the discharge (repeated discharge, Fig.49).

The view of the noise due to the wrong discharge phase as displayed on the screen of the plan position indicator is presented in Fig.50.

Noise caused by poor contact in circuit breakers and relays is observed in the form of bright wavy strips running along the range sweep (Fig.51). This noise may be equal or different for all the channels. This noise is caused by the sparking in the main contacts (mostly in circuit breakers IIIA-34 of the radio-frequency units) as well as by sparking in the

high-voltage circuit breakers or thermal strips in the motor time relays ШУ-17 and ШУ-18. In all these cases the noise is eliminated by proper adjustment of clearances and by cleaning the contacts.

Noise caused by poor grinding in brushes or dirt on rings of the increased frequency motor-generator set as well as by poor contacts in the radio-frequency contacts of circuit breakers ВВА-1П is displayed on the screen of the plan position indicator in the form of bright strips extended in azimuth.

This intermittent noise roughly coincides with the 5-degree azimuth markers (Fig.52) and appears both in one unit or in several units at once. To eliminate the noise of this kind, grind in the brushes and clean the rings of the increased frequency motor-generator set, adjust and clean the contacts of the high-voltage circuit breakers.

The noise may be also observed just while setting the receiver-transmitter cabin into rotation (at 3 r.p.m. and at 6 r.p.m.) as a result of sparking of the contacts in circuit breakers ШУ-9 and ШУ-15. This may be caused by poor contacts in the manual drive interlock of the cabin and rear locks OK-13 and OK-14. To eliminate this noise remove the interlock covers and clean or bend the contacts.

Noise caused by punctures in the magnetron or in the waveguide is detected by blips on the screen of the test oscillograph and by oscillations of the anode current millammeters of the magnetrons. The trouble is removed by replacing the magnetron, cleaning the punctures or by reducing the operating voltage slightly.

Noise caused by burnt detectors in signal mixers of the antenna switches is similar in the form to the noise caused by sparking but it passes only through the channel in which the defective detector is included. The noise disappears with the replacement of the detector.

Noise caused by poor contacts in the rotary joints may be different in nature, which depends on the circuits in which the contact is faulty. This noise differs from other kinds of noise in that it is usually located in the definite sections and disappears if the receiver-transmitter cabin is not rotated. To eliminate the noise, clean and adjust the rotary joint.

Fig.53 presents the noise as it is displayed on the screen of the plan position indicator if the contact with the brushes of the rotary joint is poor.

Noise caused by poor contact in the radio-frequency connectors and detector jacks is discovered by instability of noise and by disappearance of the echo signals in the defective channels. The noise is eliminated by improving the contacts.

(59) Troubles in Automatic Control System of Transmitting Equipment

1. While starting the increased frequency motor-generator set, type ВПЛ-12, one or several high-voltage circuit breakers of the keyer are disconnected and the FAILURE OF ONE UNIT OR COMPLETE FAILURE lamps light up. It happens in those cases when in starting the circuit breaker of the increased frequency motor-generator set the voltage is substantially reduced which causes a decrease in the speed of the fan motors of the radio-frequency units and operation of the starting circuit breakers in the increased frequency motor-generator set and the centrifugal relays that cut out the high-voltage circuit breakers of these units. In order to make further starting normal, it is sufficient to cut in the high-voltage circuit breakers disconnected during starting the increased frequency motor-generator set.

To avoid the disconnection of the circuit breakers during starting, keep the triggering voltage of the receiver-transmitter equipment at the level of 230 - 240 V and then set the normal level of 220 - 225 V.

2. Full high voltage fails to cut in. The motor time relay ШУ-18 or circuit breaker ШУ-16 are not adjusted properly.

3. High voltage disappears during operation. Poor contact in the excitation circuit of the increased frequency motor-generator set, in the exciting rheostats or in the interlocking contacts.

4. The increased frequency motor-generator set starts immediately without any time delay after the receiver-transmitter equipment is cut in. Binding in the mechanism of time relay ШУ-17 . Adjust and lubricate the relay mechanism.

5. After the equipment is off, the throttle valve of the antenna switch does not return to its initial position. The rod of the electromagnet is not adjusted properly or its core is misaligned. Adjust the electromagnet of the throttle valve.

6. Most probable trouble in the local control cabinet (besides the automatic control) is the reduction of the clearance in the adjustment chokes. In this case the magnetron current in all the channels will be low (of the order of 10 - 15 mA) and the excitation control fails to increase the current up to the normal level.

Cut off the voltage and move the choke iron plates apart. The clearance should equal 1 - 4 mm depending on the adjustment. To avoid the sticking in future, put cardboard spacers between the plates.

(60) Troubles in Starting System of Receiver-Transmitter Cabin

1. The cabin rotation speed of 3 r.p.m. is switched in only after the speed of 6 r.p.m. Lubricant got onto the rings of the centrifugal relay, on the rotation reduction unit or its brushes are not adjusted properly. Clean and adjust the centrifugal relay.

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2. The cabin fails to rotate. The operating contacts in circuit breakers ШУ-15, ШУ-9 or ШУ-87 are not adjusted properly. Adjust the circuit breakers. No contact in the OK-13 and OK-14 interlocks. Remove the covers and adjust the interlocks.

3. The change over from 6 to 3 r.p.m. is accompanied by sharp braking.

Adjust the centrifugal relay so that it operates at the cabin rotation speed of somewhat below 3 r.p.m.

4. During rotation the warning signal is not lighted. Unbond the upper contacts of the signal button.

(61) Troubles in Reflector Swinging Mechanism

1. When the swinging mechanism is started, the reflector is tilted while the selsyn receiver fails to rotate.

Slipping of the shaft of the rotor reduction unit in the reflector selsyn transmitter. Tighten up the nut of the shaft and fix the locking screw of the rotor reduction unit in the selsyn transmitter.

2. The pointer of the selsyn receiver moves with a substantial lag and not through the whole sector. When the rotor axle of the synchro repeater is turned manually two zero positions are discovered. Open circuit in one of the three conductors between the rotors of the selsyn transmitter and selsyn receiver. Ring out the circuit and eliminate the breakage.

3. The swinging mechanism fails to operate and the electric motor is overheated. Open circuit in one of the phases of the electric motor of the swinging mechanism. Replace the motor.

(62) Troubles in Keyer

Burning of coil in one of the high voltage circuit breakers. It happens if the supply circuit of the circuit

breaker is connected to the housing or if the armature disengaging tooth of the circuit breaker is subjected to jamming. Eliminate the short or adjust the armature of the circuit breaker.

With the cabinet of the radio-frequency unit completely sound, the high voltage circuit breaker fails to operate.

It happens in case the armature disengaging tooth of the circuit breaker has got out of its position.

This trouble may be repeated when the operating surfaces of the tooth become worn out. Replace the circuit breaker.

(63) Troubles in Rotary Joint

Poor contact between the brushes and rings. The probable cause may consist in the rings and brushes being dirty, in binding the brushes in the brush-holders, in shifting the contacting surface of the brush from the ring to the plastic washer. The condition of the rotary joint should be checked systematically (not less than once a month). The brush-ring resistance of the operating rotary joint should not exceed 1 - 2 ohms and it should not be changed during rotation. The brushes and rings should be wiped with dry felt or thin cloth.

2. TROUBLES IN INDICATING EQUIPMENT

(64) General

The first step in servicing a defective indicator is to locate the fault and to determine its nature.

The majority of faults in the indicating equipment may be detected by their screens.

If the range (ДА-01) or the azimuth (ЖА-50) marker units, mixer (СБ-50) or selsyn repeater (ХА-01) are defective, the nature of the fault is observed on all the indicators (no triggering, several or all the markers are not observed, the noise is not fed or it is unstable, etc.).

If only one cabinet is defective, all the other cabinets function properly if the fault does not involve cut-out of voltage in the supply circuit (in case of short circuit between the phases of the circuit).

If it is impossible to determine the nature of the fault on the indicator screens, make use of the oscillograph and voltmeter to check the defective unit through its monitoring jacks according to the Tables given below.

Use the instructions listed below in locating and removing the troubles:

1. The sweep is chaotic or there is no sweep at all on all the screens of the indicators and oscillographs in the mixer and range marker units.

In this case the trouble should be searched in the trigger stage of the range marker unit and when the equipment is started from the keyer, also in the trigger unit of the keyer circuit.

2. The range markers are chaotic or there are no markers at all on the screens of all the indicators. To locate the fault, check the markers on the screen of the oscillograph in the range marker unit and the transmission line leading to the indicators.

3. The azimuth markers are chaotic or there are no markers at all on the screens of the plan position indicators, the range and azimuth indicator. The trouble should be looked for in the azimuth marker unit or its transmission line.

4. The angle markers are chaotic or there are no markers at all on the screen of the height indicator. To carry out this check, throw the ANGLE-AZIMUTH switch to AZIMUTH. If in this case the markers are normal, the trouble should be looked for in the antenna turn angle marker unit. If the markers do not appear in this position, then the trouble should be looked for in the marker mixing and amplification stages of the height indicator.

5. Failure of the azimuth sweep or there is no sweep at all in the range and azimuth indicator as well as in the height indicator units. The trouble should be looked for in the selsyn repeater unit or its transmission line of the 1500 c.p.s. voltage leading to the indicators.

6. The sweep trace in the plan position indicator is rotated by jerks or is not rotated at all. The trouble should be looked for in the servo-motor unit or the servo amplifier.

7. No noise on the screens of all the indicators. The trouble should be looked for in the mixer.

8. No ground clutter and echo signals on the background of noise on the screens of all the indicators in one of the channels. The trouble should be looked for in the echo signal receiver and the echo signal transmission line of the defective channel.

After the trouble is located, necessity may arise in replacing a valve, tube or other parts. This may be performed without removal of the unit by opening the door of the cabinet.

To replace the tube:

- drive out four bolts and remove the scale;
- drive out six everset bolts and remove the ring from the rubber;
- take the tube holder out of the base and remove the r-f cap from the anode lead;
- turn out three bolts and release the neck of the tube;
- carefully push the tube forward from the side of the neck and then take it out of the indicator together with a piece of rubber.

To install the tube, reverse the above procedure.

While slipping the rubber pieces on the tube see to it that the anode lead is exactly between the two fastening holes in the rubber piece, otherwise the installation will be wrong.

Separate parts of the indicators may be replaced only after the unit is taken out of the compartment in the cabinet.

The valves in the range marker unit, azimuth marker unit, selsyn repeater, mixer, antenna turn angle marker unit and the servo amplifier unit are replaced from the front. To do this, drive out the holding bolts of the unit, pull slightly the unit out of the compartment. The parts in these units are replaced after it is removed from the compartment. To replace parts (resistors, capacitors, etc.) in the above units, it is not obligatory to take them out of the trucks. It is recommended to put the unit on the arm rests of the seat so that the valves face the back of the seat.

The replacement of parts in the indicator units is carried out only outside the trucks.

To take the unit out of the compartment:

(a) take position behind the cabinets and open the doors;

(b) unbend the clamps fastening the cables;

(c) screw off the union nuts in turn from the cable sections of the connectors and holding by the connector carefully separate the cable section from the instrumental one;

(d) use the socket wrench to screw off the nuts on the filament clamps, separate the filament wires and screw the nuts onto the bolts;

(e) after all the connectors and clamps are separated, take position in front of the cabinet, drive out four angle bolts and holding by the handles carefully take the unit out of the compartment.

The indicator and supply units should be removed by not less than two men.

To help in rapid location of faults, apart from the key diagrams, use should be made of the tables of voltages in the station units and of the tables for checking resistances in the station units (Appendix I.A and B).

(65) Possible Troubles in Equipment

Troubles in Range Marker Unit (ЛА-01)

Trouble	Remedy
1. Image on screen is irregular and jitters. While checking calibrator divisions:	1. Check calibrator division:
(a) no pulses of calibrator first division;	(a) replace crystal and valve 32;
(b) calibrator second divisions are irregular;	(b) replace valve 33;
(c) calibrator third divisions are irregular;	(c) replace valve 34;
(d) calibrator fourth divisions are irregular.	(d) replace valve 34.
2. Trigger pulse on indicators is normal. On screen of oscillograph image is irregular and jitters. Check circuit is faulty.	2. Tune image with CHECK TRIGGER CUT-OFF adjusting screw. Replace valve 27. Check valves 27, 29 and 30 (jacks 779, 780, 781) in check circuit.
3. Trigger pulse is normal. Shock-excited circuit sine is irregular or no sine at all.	3. Replace valve 5 or 6.
4. Trigger pulse is normal, shock-excited circuit sine is normal while markers jitter and disappear.	4. Replace valve 9 of synchronizing pulse.

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in Equipment

ker Unit (ЛА-01)

Remedy
1. Check calibrat… ivision: (a) replace crystal… alve 32; (b) replace valve … (c) replace valve … (d) replace valve …
2. Tune image with… RIGGER CUT-OFF adjust… crew. Replace valve … heck valves 27, 29 a… jacks 779, 780, 781)… heck circuit.
3. Replace valve 5…
4. Replace valve 9… ynchronizing pulse.

Trouble	Remedy
5. Steps on fast sweep are irregular and extended when marker pulses are stopped (SYNCHR. 10-, 50- and 100-km. MARKERS adjusting screws are turned counter-clockwise as far as they will go).	5. Replace diode 12.
6. 10-km. markers are disrupted and cannot be controlled.	6. Replace valve 10 or 14.
7. 50-km. markers are disrupted and cannot be controlled.	7. Replace valve 15 or 19.
8. 100-km. markers are disrupted and cannot be controlled.	8. Replace valve 20 or 24.
9. Length of scale cannot be adjusted.	9. Replace valve 2 or 3.
10. Trigger and markers on screens of indicators are normal, but no sweep on oscillograph screen, only vertical line is observed.	10. Replace valve 26.
11. No sweep, no spot on oscillograph screen.	11. Replace valve 36.
12. Image on screen of oscillograph is normal, but no sweep on indicator	12. Check contact in trigger connector 1096 and in other connectors of

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Trouble	Remedy
screens (when they are operated from calibrator).	trigger circuit according to table of radio frequency cables connection sequence.
13. Normal image on screen of oscillograph, but no range markers on indicators screens.	13. Check contact in connector 1095 and in other connectors of range marker circuit according to the same table.
14. No image on screen of oscillograph and no sweep on indicator screens (when they are operated from keyer).	14. Check contact in trigger connector 1097 and in other connectors of keyer trigger circuit.

Troubles in Plan Position Indicator (ПО-02).

Trouble	Remedy
1. No sweep and no spot on screen.	1. Check tube for filament voltage and jacks 793 and 794 for presence of voltage of +300 V and -150 V. Replace valve 25 or 18. Check BRIGHTNESS potentiometer for proper functioning.
2. There is a spot on screen, but there is no sweep.	2. Check indicator for triggering pulse (and whether there is sweep on other indicators). Check radio-frequency connectors 1013 and 1014 for proper contact.

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Trouble	Remedy
	Adjust triggering with TRIGGER CUT-OFF and DELAY TRIGGER CUT-OFF screws. Replace trigger valve 5. Use oscillograph to check jacks 754, 755, 756, 758, 759 and 760 for presence of pulses. If in any of jacks shape of oscillogram does not correspond to standard pattern or it is not displayed at all, replace respective valve. Check brushes of sweep rings for proper contact (second pair from front panel).
3. Sweep is displayed only when circuit operates without delay.	3. Delay circuit is out of order. Replace valve 2. Use oscillograph to check shape of oscillograms in jacks 752, 753 and 754.
4. When delay is employed, sweep delay is not controlled.	4. Replace valve 2. Check oscillograms in jacks 752 and 753.
5. Bright spots are observed on sweep or azimuth markers are not uniform.	5. Trigger cut-off circuit is not adjusted properly. Adjust it with TRIGGER CUT-OFF and DELAY TRIGGER CUT-OFF screws.
6. On 400-km. scale sweep is longer than 400 km. range markers are irregular.	6. Turn LENGTH of 400 KM. SWEEP screw to the left until sweep is normal.
7. There is a big point at end of sweep on 80-km. scale in sector scanning mode.	7. Turning LENGTH OF 80 KM. SWEEP to the left set normal length of sweep.

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Trouble	Remedy
8. Sweep is non--linear.	8. Replace valve 10 or 12. Check oscillograms in jacks 758, 759 and 760 on all scales.
9. Brightness of sweep on screen is maximum and it cannot be controlled or is controlled but slightly.	9. Replace valve 25 or 18. Check brightness adjusting potentiometer for open circuit.
10. Sweep cannot be focused (or is focused but insufficiently).	10. Check position of focusing coil on neck of tube. The coil should contact sweep coils. Replace valve 34. Check focusing circuit for continuity.
11. Sweep retrace is observed in case of absence of noise on screen.	11. Replace valve 42. Check oscillogram across jack 754.
12. No azimuth and range markers on sweep.	12. Turn off video channel switches, leave marker switch in ON position and adjust AZIMUTH MARKER AMPL. RANGE MARKER AMPL. and RANGE MARKER CUT-OFF screws. Check if markers from marker units are fed to other indicators. Check MARKER CONTR. switch for proper contact. Check radio-frequency connectors 1011, 1012, 1007 and 1008 for proper contacts.

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Trouble	Remedy
	Replace valves 15, 16. Check oscillograms across jacks 761, 762, 763, 765 and 766.
13. When CENTRE DISPLACEMENT switch is ON, sweep fails to shift.	13. Check CENTRE DISPLACEMENT switch for proper contact. Check for contact on brushes of rings of the centre expendion coils. Check CENTRE DISPLACEMENT potentiometer and the centre expansion coils. Replace centre expansion valve 26.
14. No noise on screen (only ECHO-VERT. switch is ON).	14. Turn VERT. ECHO AMPL. adjusting screw clockwise. Check connectors 1005 and 1006 for proper contacts. Replace valve 19.
15. No noise on screen (IDENTIFICATION switch is ON).	15. Turn IDENTIFICATION AMPLIFICATION screw clockwise. Check radio-frequency connectors 1009 and 1010 for proper contacts. Replace valve 20.
16. No noise on screen (ECHO-SLANT switch is ON).	16. Turn SLANT-ECHO AMPL. screw clockwise. Check radio-frequency connectors 1545 and 1546 for proper contacts. Replace valve 21.

Troubles in Range and Azimuth Indicator (BO-01)

The troubles listed for the plan position indicator also refer to the range and azimuth indicator.

Besides, the following troubles may occur in the azimuth and range indicator:

Trouble	Remedy
1. Azimuth sweep cannot be blanked.	1. Decrease scanning sector. Screen should cover not more than 60°. While checking use AZIMUTH SCALE knob to set sector of 40° and check blanking of sweep. Replace valves 51-48 or 49.
2. While turning antenna, sweep is not shifted vertically.	2. Replace valve 30 or 31. Check shift voltage in jacks 773 and 774. Replace valve 27 or 28. Check rotor rings of selsyn-transformer and wipe them with alcohol.
3. While turning RANGE SETTING knob, sweep is not shifted horizontally.	3. Check valves 2 and 3. Check potentiometer 124. Tighten up pin of this potentiometer.

Troubles in Height Indicator (HO-02)

The troubles listed for plan position indicator in Items 1-14 also refer to the height indicator. Besides, the following troubles may occur in the height indicator:

Trouble	Remedy
1. Angle sweep cannot be blanked.	1. Replace valves 49, 48, 51 or 53.
2. No vertical sweep.	2. Replace trigger valve 5. Replace expansion circuit valve 6. Replace valves 40, 41, 43, 44 and 45 in vertical sweep generator. Check oscillogram in jacks 804, 806, 807 and 808.

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Trouble	Remedy
3. Starting point of sweep is shifted with travel of sweep.	3. Replace valve 44.
4. No maximum limit of vertical sweep.	4. Replace valve 40, check oscillogram in jack 804.

Troubles in Mixer (CB-50)

Trouble	Remedy
1. No noise from receiver at mixer CB-50 input (main switch is at INPUT).	1. Check receivers for proper functioning.
2. Noise is fed to mixer input, but there is no noise at output prior to cut-off.	2. Replace valves 4,5 for vertical beam channel or 15 and 16 for slant beam channel; check switches 464, 466 for reliability of contacts.
3. No noise at mixer output.	3. Replace valve 7 for vertical beam channel or valve 18 for slant beam channel.
4. No noise at selector output, while with selector off noise is present.	4. Check switches 465, 467 for reliability of contacts; replace valves 6,8, 9, 10, 11, 12 in selector of vertical beam channel and valves 17, 19, 20, 21, 22, 23 in selector of slant beam channel.
5. Adjustment limits are insufficient or no blanking pulse at all. Main switch is turned to LOWER BLANK.	5. Check switch 463 for reliability of contacts and replace valves 24 or 14.

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Trouble	Remedy
6. Receiver amplification cannot be controlled.	6. Check respective amplification adjustment potentiometer for proper functioning. Check amplification remote control circuits.
7. No sweep on screen of tube but there is a point.	7. Replace valve 27.
8. No power supply is fed to anode of cathode-ray tube.	8. Replace valve 26.
9. Noise and images are stretched in shape and blurred on screen of plan position indicator.	9. Check output cables and dummies for condition.

Troubles in Servo System

1. Electric motor СЛ-262 is out of order. Replace the motor without any change in system.

2. Selsyn is inoperative. Replace selsyn and tune the respective unit completely in accordance with the instructions (See Paras 47 and 48).

Troubles in Selsyn Repeater (XA-01)

Trouble	Remedy
1. System pulls in step slowly.	1. One valve is inoperative in one of arms of servo amplifier output stage.

Trouble	Remedy
2. Neon lamp burns as selsyn repeater is rotated.	2. Electric zeroes of fine and coarse channels are shifted. Check the repeater as directed in Items 2, 3, 4, 5, 6, 7 (Para.47).
3. Same.	3. Faulty contact of brushes in selsyn transmitters or in selsyns of servo-motor unit. Wipe slip rings of selsyn rotors with rags wetted with pure alcohol.

Troubles in Power Supply Units

The main trouble of the supply units rests with the valves.

The replacement of the valves in the supply units is carried out when the doors are open.

3. Table of Monitoring Jacks

Table of Monitoring Jacks in Supply Units (БП-01)

Nos	Name of circuit	Value of reference resistor, ohms	Voltage mean value as measured by tester TT-1, V	Voltage in relation to housing, V
1	2	3	4	5
170-02	Pulsation at rectifier filter output +300 V	820,000	1.5-6.5	0

1	2	3	4	5
170-03	Pulsation at rectifier filter output -150 V	820,000	1.4-5	0
170-04	Rectifier output voltage +5500 V	4700	1.7-2.5	-150
170-05	Anode current of left half of control valve 25	1000	0.3-0.75	+300
170-06	Anode current of right half of control valve 25	1000	0.25-0.75	+300
170-07	Current through rectifier regulating valve +5000 V, valve 23	1000	0.15-0.75	-
170-08	Current through rectifier regulating valve +5000 V, valve 24	1000	0.15-0.75	-
170-09	Current through gas-filled stabilizer, valve 12	25	0.3-0.65	-
170-10	Current through cathode follower, valve 13	25 25	0.5-0.8	-
170-11	Voltage drop due to anode current in anode circuit, valve 17	10	0.4-0.8	-
170-12	Voltage drop due to anode current in anode circuit, valve 18	10	0.1-0.2	-
170-13	Current through cathode follower, valve 14	25	0.1-0.2	-
170-14	Current through rectifier control valve -150 V, valve 16	200	0.4-0.6	-
171-02	Rectifier output voltage +300 V	1000	2.6-3.4	-

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1	2	3	4	5
171-03	Rectifier output voltage -150 V	1000	1.3-1.5	-
171-05	Cathode circuits of rectifier regulating valves +300 V, valve 6	10	0.4-0.8	-
171-06	Valve 7	10	0.4-0.8	-
171-07	Valve 8	10	0.4-0.8	-
171-08	Valve 9	10	0.4-0.8	-
171-09	Valve 10	10	0.4-0.8	-
171-10	Valve 11	10	0.4-0.8	-
171-11	Valve 12	10	0.4-0.8	-
171-12	Valve 29	10	0.4-0.8	-
171-04	Current through control valve 15 of rectifier +300 V	100	0.3-0.5	-

Table of Monitoring Jacks in Power Supply Unit (БП-02)

Nos	Name of circuit	Reference resistance value, ohms	Voltage mean value as measured with tester TT-1, V	Voltage in relation to housing, V
1	2	3	4	5
170-02	Pulsation at rectifier filter output +300 V	820,000	1.5-6.5	0
170-03	Pulsation at rectifier filter output -150 V	820,000	1.4-5	0
170-09	Current through gas-filled stabilizer, valve 12	25	0.3-0.65	-

1	2	3	4	5
170-10	Current through cathode follower, valve 13	25	0.5-0.8	-
170-11	Voltage drop due to anode current in anode circuit, valve 17	10	0.4-0.8	-
170-12	Voltage drop due to anode current in anode circuit, valve 18	10	0.1-0.2	-
170-13	Current through cathode follower, valve 14	25	0.1-0.2	-
170-14	Current through rectifier, control valve -150 V, valve 16	200	0.4-0.6	-
171-02	Rectifier output voltage +300 V	1000	2.6-3.4	-
171-03	Rectifier output voltage -150 V	1000	1.3-1.5	-
171-05	Cathode circuits of rectifier control valves +300 V, valve 6	10	0.4-0.8	-
171-06	Valve 7	10	0.4-0.8	-
171-07	Valve 8	10	0.4-0.8	-
171-08	Valve 9	10	0.4-0.8	-
171-09	Valve 10	10	0.4-0.8	-
171-10	Valve 11	10	0.4-0.8	-
171-11	Valve 28	10	0.4-0.8	-
171-12	Valve 29	10	0.4-0.8	-
171-04	Current through rectifier control valve 15 (+300 V)	100	0.3-0.5	-

3	2
25	0.5-0.8
20	0.4-0.8
10	0.1-0.2
25	0.1-0.2
200	0.4-0.6
1000	2.6-3.4
1000	1.3-1.5
10	0.4-0.8
10	0.4-0.8
10	0.4-0.8
10	0.4-0.8
10	0.4-0.8
10	0.4-0.8
10	0.4-0.8
10	0.4-0.8
100	0.3-0.5

Table of Monitoring Jacks of Mixer (СБ-50)

Nos	Name of circuit	Reference resistance value, ohms	Voltage mean value as measured with tester TT-1, V	Voltage relative to housing, V
479	Voltage circuit +300 V	-	0	3.0
480	Voltage circuit -150 V	-	0	1.5

Table of Monitoring Jacks in Servo Amplifier
(УС-02 and ХА-01)

Nos	Name of circuit	Reference resistance value, ohms	Voltage mean value as measured with tester TT-1, V	Voltage relative to housing, V
1	2	3	4	5
90	Coarse channel input	10,000	0.15	0
91	Fine channel input	10,000	0.15	0
93	Cathode circuit of valve 1(1) in fine channel amplifier	1000-5700	1.5	1.5
92	Cathode circuit of valve 1(2) in coarse channel amplifier	1000	0.1	0
94	Cathode circuit of valve 2(2) in phase inverter stage	1000	0.3	0
95	Cathode circuit of valve 3 in push-pull stage	10	0.6	6

1	2	3	4	5
96	Cathode circuit of valve 4 in push-pull stage	10	0.6	6
98	Voltage circuit +300 V	1000	0.9	0.9
97	Armature circuit of electric motor СЛ-262	1000	1.5	0
115	Grid circuit of valve 1(2) in coarse channel	22000	-	0

Table of Monitoring Jacks in Azimuth Marker Unit (ЖА-50)

Nos	Name of circuit	Reference resistance value, ohms	Instrument employed for check	Voltage, V		Voltage in relation to housing, V	Oscillogram
				Tester, type TT-1	Oscillograph		
1	2	3	4	5	6	7	8
	Left Block						
141	Cathode circuit of valve 1(1)	1000	Tester TT-1			0	
142	Cathode circuit of valve 3(1)	1000	Oscillograph			-150	
143	Cathode circuit of valve 5(2)	220	Oscillograph			-150	
144	Cathode circuit of valve 5(1)	10	Oscillograph			0	

1	2	3	4	5	6	7	8
145	Anode circuit of valve 4 (2)	1000	Oscil-lograph				

Table of Monitoring Jacks in 1500 c.p.s. Voltage Generator (ГА-01)

Nos	Name of circuit	Reference resistance value, ohms	Voltage mean value as measured with tester TT-1, V	Voltage relative to housing, V
272	Voltage of master generator (grid of valve 13)	5600	0.55	0
274	Cathode circuit of valve 14 in push-pull output stage	5	0.3	-
275	Cathode circuit of valve 15 in push-pull output stage	5	0.3	-
276	Output voltage 1500 c.p.s.	470	0.3	0
278	Voltage circuit +250 V	1000	2.5	0
282	Filament circuit voltage a-a	-	6.3	0
285	Supply circuit voltage of follow-up selsyns 50 c.p.s.	1000	0.6	0

Table of Monitoring Jacks in Range Marker Unit (ДА-01)

Nos	Name of circuit	Reference resistance value, ohms	Instrument employed for check	Voltage, V		Voltage relative to housing, V	Oscillogram
				Tester, type TT-1	Oscillograph		
1	2	3	4	5	6	7	8
751	Trigger circuit in cathode circuit of valve 2(1)x)	22	Oscillograph	-	0.3-0.6	0	
752	Stretching circuit in cathode circuit of cathode follower of valve 2(2)	100	Oscillograph, tester, TT-1	0.45-0.85	0.25-0.4	0	
753	Stretching circuit in anode circuit of valve 3 (2)	100	Oscillograph, tester, TT-1	0.1-0.2	0.3-0.6	300	
754	Shock-excited circuit in cathode circuit of excitation valve 5	22	Oscillograph	-	0.35-0.55	0	
755	Shock-excited circuit in cathode circuit of cathode follower of sinusoidal voltage valve 6(2)	120	Oscillograph, tester TT-1	0.6-1.0	0.2-0.35	-150	
756	Shock-excited circuit in cathode circuit of compensating valve 7 (1)	56	Tester TT-1	0.2-0.4	-	-150	
757	Shock-excited circuit in cathode circuit of compensating valve 7 (2)	150	Oscillograph, tester TT-1	0.8-1.2	0.3-0.55	-150	

x) (1) - stands for the left half of valve in the circuit; (2)-stands for the right half of valve in the circuit.

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Table of Monitoring Jacks in Range Marker Unit (ДА-01)

Nos	Name of circuit	Reference resistance value, ohms	Instrument employed for check	Voltage, V		Voltage relative to housing, V	Oscillogram
				Tester, type TT-1	Oscillograph		
1	2	3	4	5	6	7	8
751	Trigger circuit in cathode circuit of valve 2(1)[x)]	22	Oscillograph	-	0.3-0.6	0	
752	Stretching circuit in cathode circuit of cathode follower of valve 2(2)	100	Oscillograph, tester, TT-1	0.45-0.85	0.25-0.4	0	
753	Stretching circuit in anode circuit of valve 3 (2)	100	Oscillograph, tester, TT-1	0.1-0.2	0.3-0.6	300	
754	Shock-excited circuit in cathode circuit of excitation valve 5	22	Oscillograph	-	0.35-0.55	0	
755	Shock-excited circuit in cathode circuit of cathode follower of sinusoidal voltage valve 6(2)	120	Oscillograph, tester TT-1	0.6-1.0	0.2-0.35	-150	
756	Shock-excited circuit in cathode circuit of compensating valve 7 (1)	56	Tester TT-1	0.2-0.4	-	-150	
757	Shock-excited circuit in cathode circuit of compensating valve 7 (2)	150	Oscillograph, tester TT-1	0.8-1.2	0.3-0.55	-150	

x) (1) - stands for the left half of valve in the circuit; (2)-stands for the right half of valve in the circuit.

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Table of Monitoring Jacks in Range Marker Unit (ДА-01)

Nos	Name of circuit	Reference resistance value, ohms	Instrument employed for check	Voltage, V		Voltage relative to housing, V	Oscillogram
				Tester, type TT-1	Oscillograph		
1	2	3	4	5	6	7	8
751	Trigger circuit in cathode circuit of valve 2(1)x)	22	Oscillograph	-	0.3-0.6	0	
752	Stretching circuit in cathode circuit of cathode follower of valve 2(2)	100	Oscillograph, tester, TT-1	0.45-0.85	0.25-0.4	0	
753	Stretching circuit in anode circuit of valve 3 (2)	100	Oscillograph, tester, TT-1	0.1-0.2	0.3-0.6	300	
754	Shock-excited circuit in cathode circuit of excitation valve 5	22	Oscillograph	-	0.35-0.55	0	
755	Shock-excited circuit in cathode circuit of cathode follower of sinusoidal voltage valve 6(2)	120	Oscillograph, tester TT-1	0.6-1.0	0.2-0.35	-150	
756	Shock-excited circuit in cathode circuit of compensating valve 7 (1)	56	Tester TT-1	0.2-0.4	-	-150	
757	Shock-excited circuit in cathode circuit of compensating valve 7 (2)	150	Oscillograph, tester TT-1	0.8-1.2	0.3-0.55	-150	

x) (1) - stands for the left half of valve in the circuit; (2)-stands for the right half of valve in the circuit.

Table of Monitoring Jacks in Range Marker Unit (ДА-01

Nos	Name of circuit	Reference resistance value, ohms	Instrument employed for check	Voltage, V		Voltage relative to housing V
				Tester, type TT-1	Oscillograph	
1	2	3	4	5	6	7
751	Trigger circuit in cathode circuit of valve 2(1)[x)]	22	Oscillograph	-	0.3-0.6	0
752	Stretching circuit in cathode circuit of cathode follower of valve 2(2)	100	Oscillograph, tester, TT-1	0.45-0.85	0.25-0.4	0
753	Stretching circuit in anode circuit of valve 3 (2)	100	Oscillograph, tester, TT-1	0.1-0.2	0.3-0.6	300
754	Shock-excited circuit in cathode circuit of excitation valve 5	22	Oscillograph	-	0.35-0.55	0
755	Shock-excited circuit in cathode circuit of cathode follower of sinusoidal voltage valve 6(2)	120	Oscillograph, tester TT-1	0.6-1.0	0.2-0.35	-150
756	Shock-excited circuit in cathode circuit of compensating valve 7 (1)	56	Tester TT-1	0.2-0.4	-	-150
757	Shock-excited circuit in cathode circuit of compensating valve 7 (2)	150	Oscillograph, tester TT-1	0.8-1.2	0.3-0.55	-150

x) (1) - stands for the left half of valve in the circuit; (2)-stands for th
valve in the circuit.

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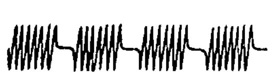
Table of Monitoring Jacks in Range Marker Unit (ДА-01)

Nos	Name of circuit	Reference resistance value, ohms	Instrument employed for check	Voltage, V		Voltage relative to housing, V	Oscillogram
				Tester, type TT-1	Oscillograph		
1	2	3	4	5	6	7	8
751	Trigger circuit in cathode circuit of valve 2(1)x)	22	Oscillograph	-	0.3-0.6	0	
752	Stretching circuit in cathode circuit of cathode follower of valve 2(2)	100	Oscillograph, tester, TT-1	0.45-0.85	0.25-0.4	0	
753	Stretching circuit in anode circuit of valve 3 (2)	100	Oscillograph, tester, TT-1	0.1-0.2	0.3-0.6	300	
754	Shock-excited circuit in cathode circuit of excitation valve 5	22	Oscillograph	-	0.35-0.55	0	
755	Shock-excited circuit in cathode circuit of cathode follower of sinusoidal voltage valve 6(2)	120	Oscillograph, tester TT-1	0.6-1.0	0.2-0.35	-150	
756	Shock-excited circuit in cathode circuit of compensating valve 7 (1)	56	Tester TT-1	0.2-0.4	-	-150	
757	Shock-excited circuit in cathode circuit of compensating valve 7 (2)	150	Oscillograph, tester TT-1	0.8-1.2	0.3-0.55	-150	

x) (1) - stands for the left half of valve in the circuit; (2)-stands for the right half of valve in the circuit.

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Table of Monitoring Jacks in Range Marker Unit (ДА-01)

Nos	Name of circuit	Reference resistance value, ohms	Instrument employed for check	Voltage, V		Voltage relative to housing, V	Oscillogram
				Tester, type TT-1	Oscillograph		
1	2	3	4	5	6	7	8
751	Trigger circuit in cathode circuit of valve 2(1)x)	22	Oscillograph	-	0.3-0.6	0	
752	Stretching circuit in cathode circuit of cathode follower of valve 2(2)	100	Oscillograph, tester, TT-1	0.45-0.85	0.25-0.4	0	
753	Stretching circuit in anode circuit of valve 3 (2)	100	Oscillograph, tester, TT-1	0.1-0.2	0.3-0.6	300	
754	Shock-excited circuit in cathode circuit of excitation valve 5	22	Oscillograph	-	0.35-0.55	0	
755	Shock-excited circuit in cathode circuit of cathode follower of sinusoidal voltage valve 6(2)	120	Oscillograph, tester TT-1	0.6-1.0	0.2-0.35	-150	
756	Shock-excited circuit in cathode circuit of compensating valve 7 (1)	56	Tester TT-1	0.2-0.4	-	-150	
757	Shock-excited circuit in cathode circuit of compensating valve 7 (2)	150	Oscillograph, tester TT-1	0.8-1.2	0.3-0.55	-150	

x) (1) - stands for the left half of valve in the circuit; (2)-stands for the right half of valve in the circuit.

Table of Monitoring Jacks in Range Marker Unit (ДА-01

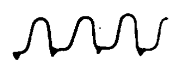
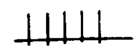
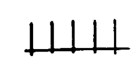
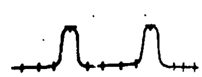
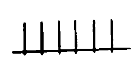
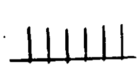
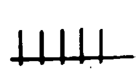
Nos	Name of circuit	Reference resistance value, ohms	Instrument employed for check	Voltage, V		Voltage relative to housing V
				Tester, type TT-1	Oscillograph	
1	2	3	4	5	6	7
751	Trigger circuit in cathode circuit of valve 2(1)x)	22	Oscillograph	-	0.3-0.6	0
752	Stretching circuit in cathode circuit of cathode follower of valve 2(2)	100	Oscillograph, tester, TT-1	0.45-0.85	0.25-0.4	0
753	Stretching circuit in anode circuit of valve 3 (2)	100	Oscillograph, tester, TT-1	0.1-0.2	0.3-0.6	300
754	Shock-excited circuit in cathode circuit of excitation valve 5	22	Oscillograph	-	0.35-0.55	0
755	Shock-excited circuit in cathode circuit of cathode follower of sinusoidal voltage valve 6(2)	120	Oscillograph, tester TT-1	0.6-1.0	0.2-0.35	-150
756	Shock-excited circuit in cathode circuit of compensating valve 7 (1)	56	Tester TT-1	0.2-0.4	-	-150
757	Shock-excited circuit in cathode circuit of compensating valve 7 (2)	150	Oscillograph, tester TT-1	0.8-1.2	0.3-0.55	-150

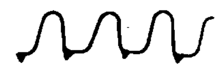
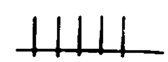
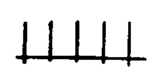
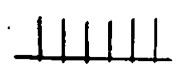
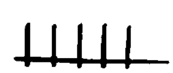
x) (1) - stands for the left half of valve in the circuit; (2)-stands for th
valve in the circuit.

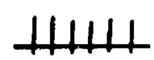
Table of Monitoring Jacks in Range Marker Unit (ДА-01)

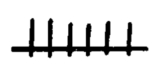
Nos	Name of circuit	Reference resistance value, ohms	Instrument employed for check	Voltage, V		Voltage relative to housing, V	Oscillogram
				Tester, type TT-1	Oscillograph		
1	2	3	4	5	6	7	8
751	Trigger circuit in cathode circuit of valve 2(1)x)	22	Oscillograph	-	0.3-0.6	0	
752	Stretching circuit in cathode circuit of cathode follower of valve 2(2)	100	Oscillograph, tester, TT-1	0.45-0.85	0.25-0.4	0	
753	Stretching circuit in anode circuit of valve 3 (2)	100	Oscillograph, tester, TT-1	0.1-0.2	0.3-0.6	300	
754	Shock-excited circuit in cathode circuit of excitation valve 5	22	Oscillograph	-	0.35-0.55	0	
755	Shock-excited circuit in cathode circuit of cathode follower of sinusoidal voltage valve 6(2)	120	Oscillograph, tester TT-1	0.6-1.0	0.2-0.35	-150	
756	Shock-excited circuit in cathode circuit of compensating valve 7 (1)	56	Tester TT-1	0.2-0.4	-	-150	
757	Shock-excited circuit in cathode circuit of compensating valve 7 (2)	150	Oscillograph, tester TT-1	0.8-1.2	0.3-0.55	-150	

x) (1) - stands for the left half of valve in the circuit; (2)-stands for the right half of valve in the circuit.

1	2	3	4	5	6	7	8
758	2-km. markers shaping in cathode circuit of synchronizing valve 9 (1)	22	Oscillograph, tester TT-1	0.15-0.25	0.2-0.35	0	
759	2-km. markers shaping in cathode circuit of 2-km. blocking oscillator, valve 9 (2)	5	Oscillograph	-	0.7-1.4	0	
760	10-km. markers shaping in cathode circuit of synchronizing valve, valve 10 (1)	22	Oscillograph	-	0.6-1.2	0	
761	10-km. markers shaping in cathode circuit of synchronizing valve, valve 10 (2)	100	Oscillograph, tester TT-1	0.25-0.45	0.15-0.25	-150	
762	10-km. markers shaping in cathode circuit of main blocking oscillator, valve 11 (1)	5	Oscillograph	-	1.3-1.9	0	
763	10-km. markers shaping in valve cathode circuit of auxiliary blocking oscillator, valve 13 (1)	5	Oscillograph	-	0.8-1.2	0	
764	10-km. markers shaping in anode line of auxiliary stretching circuit, valve 14 (2)	100	Oscillograph, tester TT-1	0.6-0.8	0.6-0.8	+300	
765	50-km. markers shaping in cathode circuit of synchronizing valve, valve 15 (1)	22	Oscillograph	-	0.6-1.2	0	

1	2	3	4	5	6	7	8
758	2-km. markers shaping in cathode circuit of synchronizing valve 9 (1)	22	Oscillograph, tester TT-1	0.15-0.25	0.2-0.35	0	
759	2-km. markers shaping in cathode circuit of 2-km. blocking oscillator, valve 9 (2)	5	Oscillograph	-	0.7-1.4	0	
760	10-km. markers shaping in cathode circuit of synchronizing valve, valve 10 (1)	22	Oscillograph	-	0.6-1.2	0	
761	10-km. markers shaping in cathode circuit of synchronizing valve, valve 10 (2)	100	Oscillograph, tester TT-1	0.25-0.45	0.15-0.25	-150	
762	10-km. markers shaping in cathode circuit of main blocking oscillator, valve 11 (1)	5	Oscillograph	-	1.3-1.9	0	
763	10-km. markers shaping in valve cathode circuit of auxiliary blocking oscillator, valve 13 (1)	5	Oscillograph	-	0.8-1.2	0	
764	10-km. markers shaping in anode line of auxiliary stretching circuit, valve 14 (2)	100	Oscillograph, tester TT-1	0.6-0.8	0.6-0.8	+300	
765	50-km. markers shaping in cathode circuit of synchronizing valve, valve 15 (1)	22	Oscillograph	-	0.6-1.2	0	

1	2	3	4	5	6	7	8
766	50-km. markers shaping in cathode circuit of synchronizing valve, valve 15 (2)	100	Oscillograph; tester TT-1	0.25-0.48	0.2-0.35	-150	
767	50-km. markers shaping in valve cathode circuit of blocking oscillator, valve 16(1)	5	Oscillograph	-	1.3-1.9	0	
768	50-km. markers shaping in diode cathode circuit of storage cell, valve 17 (1)	0.1 μF	Oscillograph	-	0.3-0.6	0	
769	50-km. markers shaping in valve cathode circuit of auxiliary blocking oscillator, valve 18 (1)	5	Oscillograph	-	1.3-1.9	0	
770	50-km. markers shaping in anode circuit of auxiliary stretching circuit, valve 19 (2)	100	Oscillograph, tester TT-1	0.6-0.9	0.4-0.8	+300	
771	100-km. markers shaping in cathode circuit of synchronizing valve, valve 20 (1)	22	Oscillograph	-	0.6-1.2	0	
772	100-km. markers shaping in cathode circuit of synchronizing valve 20 (2)	100	Oscillograph, tester TT-1	0.2-0.4	0.2-0.4	-150	
773	100-km. markers shaping in valve cathode circuit of main blocking oscillator, valve 21 (1)	5	Oscillograph	-	1.3-1.9	0	

1	2	3	4	5	6	7	8
766	50-km. markers shaping in cathode circuit of synchronizing valve, valve 15 (2)	100	Oscillograph, tester TT-1	0.25-0.48	0.2-0.35	-150	
767	50-km. markers shaping in valve cathode circuit of blocking oscillator, valve 16(1)	5	Oscillograph	-	1.3-1.9	0	
768	50-km. markers shaping in diode cathode circuit of storage cell, valve 17 (1)	0.1 μF	Oscillograph	-	0.3-0.6	0	
769	50-km. markers shaping in valve cathode circuit of auxiliary blocking oscillator, valve 18 (1)	5	Oscillograph	-	1.3-1.9	0	
770	50-km. markers shaping in anode circuit of auxiliary stretching circuit, valve 19 (2)	100	Oscillograph, tester TT-1	0.6-0.9	0.4-0.8	+300	
771	100-km. markers shaping in cathode circuit of synchronizing valve, valve 20 (1)	22	Oscillograph	-	0.6-1.2	0	
772	100-km. markers shaping in cathode circuit of synchronizing valve 20 (2)	100	Oscillograph, tester TT-1	0.2-0.4	0.2-0.4	-150	
773	100-km. markers shaping in valve cathode circuit of main blocking oscillator, valve 21 (1)	5	Oscillograph	-	1.3-1.9	0	

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1	2	3	4	5	6	7	8
766	50-km. markers shaping in cathode circuit of synchronizing valve, valve 15 (2)	100	Oscillograph, tester TT-1	0.25-0.48	0.2-0.35	-150	
767	50-km. markers shaping in valve cathode circuit of blocking oscillator, valve 16(1)	5	Oscillograph	-	1.3-1.9	0	
768	50-km. markers shaping in diode cathode circuit of storage cell, valve 17 (1)	0.1 μF	Oscillograph	-	0.3-0.6	0	
769	50-km. markers shaping in valve cathode circuit of auxiliary blocking oscillator, valve 18 (1)	5	Oscillograph	-	1.3-1.9	0	
770	50-km. markers shaping in anode circuit of auxiliary stretching circuit, valve 19 (2)	100	Oscillograph, tester TT-1	0.6-0.9	0.4-0.8	+300	
771	100-km. markers shaping in cathode circuit of synchronizing valve, valve 20 (1)	22	Oscillograph	-	0.6-1.2	0	
772	100-km. markers shaping in cathode circuit of synchronizing valve 20 (2)	100	Oscillograph, tester TT-1	0.2-0.4	0.2-0.4	-150	
773	100-km. markers shaping in valve cathode circuit of main blocking oscillator, valve 21 (1)	5	Oscillograph	-	1.3-1.9	0	

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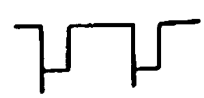
1	2	3	4	5	6	7	8
774	100-km. markers shaping in diode cathode circuit of storage cell, valve 22 (1)	0.1 μF	Oscillograph	-	0.1-0.3	0	
775	100-km. markers shaping in valve cathode circuit of auxiliary blocking oscillator, valve 23 (1)	5	Oscillograph	-	1.3-1.9	0	
776	100-km. markers shaping in anode circuit of auxiliary stretching circuit, valve 24 (2)	100	Oscillograph, tester TT-1	0.6-1.2	0.4-0.8	+300	
	In Marker Control Circuit						
777	Trigger circuit in cathode circuit of trigger valve, valve 26 (1)	22	Oscillograph	-	0.4-0.8	0	
778	Stretching circuit in cathode circuit of cathode follower in stretching circuit, valve 26 (2)	100	Oscillograph, tester TT-1	0.2-0.6	0.25-0.45	0	
779	Stretching circuit in valve anode circuit of stretching valve, valve 27 (2)	100	Tester TT-1	0.25-0.45	0.3-0.6	+300	
780	Sweep circuit in cathode circuit of compensating valve, valve 29 (1)	100	Oscillograph	0.3-0.5	0.15-0.3	-150	

1	2	3	4	5	6	7	8
774	100-km. markers shaping in diode cathode circuit of storage cell, valve 22 (1)	0.1 μF	Oscillograph	-	0.1-0.3	0	
775	100-km. markers shaping in valve cathode circuit of auxiliary blocking oscillator, valve 23 (1)	5	Oscillograph	-	1.3-1.9	0	
776	100-km. markers shaping in anode circuit of auxiliary stretching circuit, valve 24 (2)	100	Oscillograph, tester TT-1	0.6-1.2	0.4-0.8	+300	
	In Marker Control Circuit						
777	Trigger circuit in cathode circuit of trigger valve, valve 26 (1)	22	Oscillograph	-	0.4-0.8	0	
778	Stretching circuit in cathode circuit of cathode follower in stretching circuit, valve 26 (2)	100	Oscillograph, tester TT-1	0.2-0.6	0.25-0.45	0	
779	Stretching circuit in valve anode circuit of stretching valve, valve 27 (2)	100	Tester TT-1	0.25-0.45	0.3-0.6	+300	
780	Sweep circuit in cathode circuit of compensating valve, valve 29 (1)	100	Oscillograph	0.3-0.5	0.15-0.3	-150	

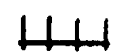
1	2	3	4	5	6	7	8
1	Sweep circuit in cathode circuit of phase inverter stage valve, valve 30	56	Oscillo-graph	0.25-0.45	0.3-0.5	0	
	In Calibrator Circuit						
82	Crystal oscillator circuit in cathode circuit of crystal oscillator, valve 32 (1)	5	Oscillo-graph	-	1.3-1.6	0	
83	Sinusoidal voltage forming circuit in cathode circuit of sinusoidal voltage forming valve, valve 33	22	Oscillo-graph, tester TT-1	0.1-0.25	0.35-0.55	0	
84	Synchronizing stage circuit in cathode circuit of output pulse synchronizing valve, valve 35 (1)	22	Oscillo-graph	-	0.45-0.9	0	
	In Supply Circuits						
785	Voltage divider circuit of tube, rectifier voltage 1 kV	820	Tester TT-1	0.8-1.4	-	0	
786	Filament circuit 6.3 V	-	Tester TT-1	6.0-6.6	-	0	
787	Voltage circuit -150 V	1000	Tester TT-1	1.2-1.8	-	0	
788	Voltage circuit +300 V	1000	Tester TT-1	2.5-3.0	-	0	

Table of Monito

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Nos	Name of circuit	Reference resistance value, ohms	Ins emp for
261	Cathode circuit of valve 1 in 5-degree angle pulses shaping circuit	1000	Os gra tes
262	Cathode circuit of valve 2 in 5-degree angle pulses shaping circuit	100	Os gra t
263	Cathode circuit of valve 3 in trigger mixer stage	56	Os gra tes
266	Cathode circuit of valve 6(1) in 5-degree marker shaping circuit	220	Os gra ter
267	Cathode circuit of valve 6 (2) in blocking oscillator of 5-degree markers		
278	Voltage circuit +300 V, connector 1072, pin 13	1000	Tes
279	Voltage circuit -150 V	-	Tes
281	Filament circuit C-C	-	Tes

1	2	3
763	Cathode circuit of amplification and mixing valve 17	56
766	Cathode circuit of valve 18(2) in cathode follower of marker output circuit	56
767	Cathode circuit of echo signal amplification valve 19 of vertical beam channel	56
768	Cathode circuit of echo signal amplification valve 20 in slant beam channel	56
769	Cathode circuit of identification signal amplification valve 21	56
771	Cathode circuit of valve 25 (2) in amplification output circuit	56
793	Voltage circuit +300 V	1000
794	Voltage circuit -150 V	1000
765	Filament circuit a-a	-
796	Filament circuit b-b	-
797	Filament circuit c-c	-
809	Filament circuit f-f	-

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Nos	Nam
1	
752	Cat! valve cuit
753	Cat! valve de fol
754	Trig cuit c
755	Cath valve follow
756	Anod valve ching
758	Cath discha:
759	Cath valve : ference
760	Cathc valves sweep c

1	2	3
763	Cathode circuit of amplification and mixing valve 17	56
766	Cathode circuit of valve 18(2) in cathode follower of marker output circuit	56
767	Cathode circuit of echo signal amplification valve 19 of vertical beam channel	56
768	Cathode circuit of echo signal amplification valve 20 in slant beam channel	56
769	Cathode circuit of identification signal amplification valve 21	56
771	Cathode circuit of valve 25 (2) in amplification output circuit	56
793	Voltage circuit +300 V	1000
794	Voltage circuit -150 V	1000
795	Filament circuit a-a	-
796	Filament circuit b-b	-
797	Filament circuit c-c	-
809	Filament circuit f-f	-

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Table of Monitoring Jacks in Antenna Turn Angle Marker Unit (3A-01)

[illegible]	Name of circuit	Reference resistance value, ohms	Instrument employed for check	Voltage, V		Voltage relative to housing, V	Oscillogram
				Tester, type TT-1	Oscillograph		
[illegible]	Cathode circuit of valve [illegible] in 5-degree angle pulses shaping circuit	1000	Oscillograph, tester TT-1, 1 V	0.30	0.43	0	
[illegible]	Cathode circuit of valve 2 in 5-degree angle pulses shaping circuit	100	Oscillograph, tester TT-1	0.62	0.90	0	
[illegible]	Cathode circuit of valve [illegible] in trigger [illegible] stage	56	Oscillograph, tester TT-1, 1 V	0.7	0.51	0	
[illegible]	Cathode circuit of valve 5(1) in 5-degree marker shaping circuit	220	Oscillograph, tester TT-1, 1 V	0.50-0.60	0.72-0.12	-150	
[illegible]	Cathode circuit of valve 6 (2) in blocking oscillator of 5-degree markers						
[illegible]	Voltage circuit +300 V, connector 1072, pin 13	1000	Tester TT-1, 10 V	2.6	-	0	
[illegible]	Voltage circuit -150 V	-	Tester TT-1, 10 V	1.25	-	0	
[illegible]	Filament circuit C-C	-	Tester TT-1, 10 V	4.5	-	0	

Table of Monitoring Jacks in Plan Position Indicator (П0-02)

Nos	Name of circuit	Reference resistance value, ohms	Instrument employed for check	Voltage, V		Voltage in relation to housing, V	Oscillogram	Note
				Tester, type TT-1	Oscillograph			
1	2	3	4	5	6	7	8	9
752	Cathode circuit of valve 2 in delay circuit	1000	Tester TT-1, oscillograph	0.1	0.8	0		At delay value of 150 km.
753	Cathode circuit of valve 3 (1) in cathode follower	100	Ditto	0.05	0.4	0		Ditto
754	Trigger cathode circuit of valve 5 (1)	22	Ditto	0.25	1.2	0		At given trigger cut-off value
755	Cathode circuit of valve 5 (2) in cathode follower	100	Ditto	0.3	1.0	0		
756	Anode circuit of valve 6 (2) in stretching circuit	100	Ditto	0.3	0.8	300		
758	Cathode circuit of discharge valve 9	56	Ditto	0.3	1.1	0		
759	Cathode circuit of valve 11 (2) of difference amplifier	100	Ditto	0.1	0.7	0		
760	Cathode circuit of valves 14 and 13 of sweep output	5	Ditto	0.2	1.2	0		
761	Cathode circuit of valve 15 (1) of range marker cathode follower	150	Ditto	0.7	1.5	0	Range marker pulses are observed	At given range cut-off value
762	Cathode circuit of valve 15(2) of azimuth marker cathode follower	150	Ditto	0.7	1.5	0	Azimuth marker pulses are observed	At given azimuth cut-off value

Table of Monitoring Jacks in Plan Position Indicator (ПО-02)

Nos	Name of circuit	Reference resistance value, ohms	Instrument employed for check	Voltage, V Tester, type TT-1	Voltage, V Oscillograph	Voltage in relation to housing, V	Oscillogram	N o t
1	2	3	4	5	6	7	8	9
752	Cathode circuit of valve 2 in delay circuit	1000	Tester TT-1, oscillograph	0.1	0.8	0		At del of 150 k
753	Cathode circuit of valve 3 (1) in cathode follower	100	Ditto	0.05	0.4	0		Dit
754	Trigger cathode circuit of valve 5 (1)	22	Ditto	0.25	1.2	0		At giv cut-off
755	Cathode circuit of valve 5 (2) in cathode follower	100	Ditto	0.3	1.0	0		
756	Anode circuit of valve 6 (2) in stretching circuit	100	Ditto	0.3	0.8	300		
758	Cathode circuit of discharge valve 9	56	Ditto	0.3	1.1	0		
759	Cathode circuit of valve 11 (2) of difference amplifier	100	Ditto	0.1	0.7	0		
760	Cathode circuit of valves 14 and 13 of sweep output	5	Ditto	0.2	1.2	0		
761	Cathode circuit of valve 15 (1) of range marker cathode follower	150	Ditto	0.7	1.5	0	Range marker pulses are observed	At giv cut-off
762	Cathode circuit of valve 15(2) of azimuth marker cathode follower	150	Ditto	0.7	1.5	0	Azimuth marker pulses are observed	At giv cut-off

Table of Monitoring Jacks in Range and Azimuth Indicator (BO-01)

Nos	Name of circuit	Reference resistance value, ohms	Instrument employed for check	Voltage, V		Voltage in relation to housing, V	Oscillogram	Notes
				Tester, type TT-1	Oscillograph			
1	2	3	4	5	6	7	8	9
752	Cathode circuit of valve 2 in delay circuit	100	Tester TT-1, oscillograph	0.1	0.8	0		At delay of 150 km.
753	Cathode circuit of valve 3 (1) of cathode follower	100	Ditto	0.05	0.4	0		Ditto
754	Cathode circuit of trigger valve 5(1)	22	Ditto	0.25	1.2	0		At given cut-off value
755	Cathode circuit of valve 5 (2) in cathode follower	100	Ditto	0.5	1.3	0		On 100-km. scale
756	Anode circuit of valve 6 (2) in stretching circuit	100	Ditto	0.3	1.2	300		100 km.
758	Cathode circuit of discharge valve 9	56	Ditto	0.1	0.8	0		100 km.
759	Cathode circuit of valve 11 (2) of difference amplifier	100	Tester TT-1, oscillograph	0.2	0.8	0		100 km.
760	Cathode circuit of valve 13 of sweep output	5	Ditto	0.2	0.85	0		100 km.
761	Cathode circuit of valve 15 (1) of range marker cathode follower	150	Ditto	0.7	1.5	0	Range marker pulses are observed	At given range cut-off value

Table of Monitoring Jacks in Range and Azimuth Indicator (BO-01)

Nos	Name of circuit	Reference resistance value, ohms	Instrument employed for check	Voltage, V		Voltage in relation to housing, V	Oscillogram	N
				Tester, type TT-1	Oscillograph			
1	2	3	4	5	6	7	8	
752	Cathode circuit of valve 2 in delay circuit	100	Tester TT-1, oscillograph	0.1	0.8	0		At 150
753	Cathode circuit of valve 3 (1) of cathode follower	100	Ditto	0.05	0.4	0		Di
754	Cathode circuit of trigger valve 5(1)	22	Ditto	0.25	1.2	0		At off v
755	Cathode circuit of valve 5 (2) in cathode follower	100	Ditto	0.5	1.3	0		On 10
756	Anode circuit of valve 6 (2) in stretching circuit	100	Ditto	0.3	1.2	300		10
758	Cathode circuit of discharge valve 9	56	Ditto	0.1	0.8	0		10
759	Cathode circuit of valve 11 (2) of difference amplifier	100	Tester TT-1, oscillograph	0.2	0.8	0		10
760	Cathode circuit of valve 13 of sweep output	5	Ditto	0.2	0.85	0		100
761	Cathode circuit of valve 15 (1) of range marker cathode follower	150	Ditto	0.7	1.5	0	Range marker pulses are observed	At gi cut-off

1	2	3	4	5	6	7	8	9
762	Cathode circuit of valve 15 (2) of azimuth marker cathode follower	150	Tester TT-1, oscillograph	0.7	1.5	0	Azimuth marker pulses are observed	At given azimuth cut-off value
763	Cathode circuit of amplification and mixing valve 17	56	Ditto	0.3	0.7	-150	Azimuth and range marker pulses are observed	At given azimuth and range cut-off values
766	Cathode circuit of valve 18 (2) in cathode follower	56	Ditto	0.6	1.1	-150	Azimuth and range marker pulses are observed	At given brightness value
767	Cathode circuit of echo signal amplification valve 19 in vertical beam channel	56	Tester TT-1	0.15	-	0	-	At given amplification value
768	Cathode circuit of identification signal amplification valve 20	56	Ditto	0.15	-	0	-	Ditto
769	Cathode circuit of signal amplification valve 21 in slant channel	56	Ditto	0.15	-	0	-	Ditto
771	Cathode circuit of valve 25 (2) in output amplification circuit	56	Ditto	0.3	-	0	-	Ditto
772	Recharging circuit of capacitor in controlled rectifier 576	220	Oscillograph	-	0.2-0.9	0		At sweep scale of 60°
773	Cathode circuit of valve 27 (1) in cathode follower	100	Tester TT-1, oscillograph	0.3	0.75	0		At displacement angle
774	Cathode circuit of valve 27 (2) in cathode follower	10	Tester TT-1	0.14	-	0	2	-

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2	3	4	5	6	7	8	9
athode circuit of ve 15 (2) of azimuth ker cathode follower	150	Tester TT-1, oscillo-graph	0.7	1.5	0	Azimuth marker pulses are observed	At given azimuth cut-off value
athode circuit of lification and mix- valve 17	56	Ditto	0.3	0.7	-150	Azimuth and range marker pulses are observed	At given azimuth and range cut-off values
athode circuit of lve 18 (2) in catho- follower	56	Ditto	0.6	1.1	-150	Azimuth and range marker pulses are observed	At given brightness value
Cathode circuit of ho signal amplifica- on valve 19 in ver- cal beam channel	56	Tester TT-1	0.15	-	0	-	At given amplification value
Cathode circuit of entification signal plification valve 20	56	Ditto	0.15	-	0	-	Ditto
Cathode circuit of ignal amplification alve 21 in slant hannel	56	Ditto	0.15	-	0	-	Ditto
Cathode circuit of alve 25 (2) in output plification circuit	56	Ditto	0.3	-	0	-	Ditto
Recharging circuit f capacitor in cont- olled rectifier 576	220	Oscillo-graph	-	0.2-0.9	0		At sweep scale of 60°
Cathode circuit of alve 27 (1) in catho- e follower	100	Tester TT-1, oscillo-graph	0.3	0.75	0		At displacement angle
Cathode circuit of alve 27 (2) in catho- e follower	10	Tester TT-1	0.14	-	0		-

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2	3	4	5	6	7	8	9
Cathode circuit of valve 30 in D.C. amplifier	10	Tester TT-1	0.9	-	-	-	At displacement angle of 10°
Cathode circuit of valve 31 in D.C. amplifier	10	Ditto	0.3	-	-	-	Ditto
Voltage circuit +300 V	1000	Ditto	2.5	-	-	-	-
Voltage circuit -150 V	1000	Ditto	1.2	-	-	-	-
Filament circuit a-a	-	AC tester TT-1, 10 V	5.7-6.3	-	-	-	-
Filament circuit b-b	-	Ditto	5.8-6.3	300	-	-	-
Filament circuit c-c	-	Ditto	5.8-6.3	300	-	-	-
Filament circuit d-d	-	Ditto	5.8-6.3	100	-	-	-
Filament circuit f-f	-	Ditto	5.8-6.3	95	-	-	-

1	2	3	4	5	6	7	8	9
775	Cathode circuit of valve 30 in D.C. amplifier	10	Tester TT-1	0.9	-	-	-	At displaceme[nt] angle of 10°
776	Cathode circuit of valve 31 in D.C. amplifier	10	Ditto	0.3	-	-	-	Ditto
793	Voltage circuit +300 V	1000	Ditto	2.5	-	-	-	-
794	Voltage circuit -150 V	1000	Ditto	1.2	-	-	-	-
795	Filament circuit a-a	-	AC tester TT-1, 10 V	5.7-6.3	-	-	-	-
796	Filament circuit b-b	-	Ditto	5.8-6.3	300	-	-	-
797	Filament circuit c-c	-	Ditto	5.8-6.3	300	-	-	-
798	Filament circuit d-d	-	Ditto	5.8-6.3	100	-	-	-
809	Filament circuit f-f	-	Ditto	5.8-6.3	95	-	-	-

Table of Monitoring Jacks in Height Indicator (HO-02)

Nos	Name of circuit	Reference resistance value, ohms	Instrument employed for check	Voltage, V		Voltage in relation to housing, V	Oscillogram	Notes
				Tester, type TT-1	Oscillograph			
1	2	3	4	5	6	7	8	9
754	Cathode circuit of trigger valve 5(1)	22	Tester TT-1, oscillograph	0.4	0.85	0		At given cut-off value
755	Cathode circuit of valve 5 (2) in cathode follower	100	Ditto	0.6	0.85	0		On 100-km. scale
756	Anode circuit of valve 6 (2) in stretching circuit	100	Ditto	0.65	0.85	300		Ditto
758	Cathode circuit of discharge valve 9	56	Ditto	0.2	0.3	0		Ditto
759	Cathode circuit of valve 11 (2) in difference amplifier	100	Tester TT-1, oscillograph	0.25	0.5	0		On 100-km. scale
760	Cathode circuit of valve 13 in sweep output	5	Ditto	0.25	0.8	0		Ditto
761	Cathode circuit of valve 15 (1) in range marker cathode follower	150	Ditto	0.95	1.2	0	Range marker pulses are observed	At given range cut-off value
762	Cathode circuit of valve 15 (2) in azimuth marker cathode follower	150	Ditto	0.7	1.2	0	Range marker pulses are observed	At given azimuth cut-off value
763	Cathode circuit of amplification and mixing valve 17	56	Ditto	0.5	1	0	Azimuth and range marker pulses are observed	At given range and azimuth cut-off values

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Table of Monitoring Jacks in Height Indicator (HO-02)

circuit	Reference resistance value, ohms	Instrument employed for check	Voltage, V		Voltage in relation to housing, V	Oscillogram	Notes
			Tester, type TT-1	Oscillograph			
2	3	4	5	6	7	8	9
circuit of alve 5(1)	22	Tester TT-1, oscillograph	0.4	0.85	0		At given cut-off value
circuit of cathode	100	Ditto	0.6	0.85	0		On 100-km. scale
	100	Ditto	0.65	0.85	300		Ditto
valve		Ditto	0.2	0.3	0		Ditto
circuit of (2) in diffe- lifier	100	Tester TT-1, oscillograph	0.25	0.5	0		On 100-km. scale
circuit of in sweep out-	5	Ditto	0.25	0.8	0		Ditto
circuit of (1) in range thode follower	150	Ditto	0.95	1.2	0	Range marker pulses are observed	At given range cut-off value
circuit of (2) in azimuth thode follower	150	Ditto	0.7	1.2	0	Range marker pulses are observed	At given azimuth cut-off value
circuit of tion and mix- 17	56	Ditto	0.5	1	0	Azimuth and range marker pulses are observed	At given range and azimuth cut-off values

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	5	6	7	8	9
te: ·d	0.3–0.55	-	-150	-	At displacement angle of 10°
te: d, dio- pl	0.65	1.0	0		Ditto
tto	0.1	0.3	0		Ditto
tto	0.2	0.35	0		Ditto
tto	2.5	3.4	0	-	-
tto	1.2	1.8	0	-	-
te: ы	5.7–6.3	-	0	-	-
tto	5.8–6.3	-	300	-	-
tto	5.8–6.3	-	100	-	-
tto	5.8–6.3	-	35	-	-

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APPENDIX 14

VOLTAGE CHECK TABLE FOR UNITS OF STATION

Types of valves	Position of controls during measurement	Numbers of pins in valves							
		1	2	3	4	5	6	7	8
2	3	4	5	6	7	8	9	10	11
			Azimuth Marker Unit IA-50						
6H8C	Operating voltage, V Adjustment range of LENGTH OF MARKER screw	-10	287	50-60	-1.5 0.5-2	-1.5 0.5-2	10-15	Filament	Filament
6H7C	Operating voltage, V Without trigger pulse, V Adjustment range of LENGTH OF MARKER screw		Filament	287 295	-39 -40	-1.5 0.6 0.5 to -2.0	85 81	Filament	0 0
6H8C	Operating voltage, V Selsyn repeater in 30° marker position	-130	130-210 298	0.5	-140	300	-125	Filament	Filament
5H8C	Operating voltage, V	50	295	65	28	300	60	Filament	Filament
5H8C	Operating voltage, V Selsyn repeater in 30° marker position	-140	-1 to -8 -85	-55 to -125 -135	-135 to -155	0	-55 to -125 -135	Filament	Filament
H8C	Operating voltage, V Adjustment range of RELATION OF AMPL. MARKER screw	-130	225-240	0.5	0 to -8	205-225	6.5-8.5 8.5-10.5- -0	Filament	Filament
3C	Operating voltage, V Selsyn repeater in 30° marker position		Filament	300	300	60-150 295		Filament	120-180 295
8C	Operating voltage, V	0	265	13	0	180	7	Filament	Filament
3C	Operating voltage, V		Filament	300	300	0		Filament	25
3C	Operating voltage, V		Filament	300	300	0		Filament	25

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VOLTAGE CHECK TABLE FOR UNITS OF STATION

Reference numbers in diagram	Types of valves	Position of controls during measurement	Numbers of pins in valves					
			1	2	3	4	5	6
1	2	3	4	5	6	7	8	9
				Azimuth Marker Unit KA-50				
1	6H8C	Operating voltage, V Adjustment range of LENGTH OF MARKER screw	-10	287	50-60	-1.5 0.5-2	-1.5 0.5-2	10-15
2	6H7C	Operating voltage, V Without trigger pulse, V Adjustment range of LENGTH OF MARKER screw		Filament	287 295	-39 -40	-1.5 0.6 0.5 to -20	85 81
5	6H8C	Operating voltage, V Selsyn repeater in 30° marker position	-130	130-210 298	0.5	-140	300	-125
6	6H8C	Operating voltage, V	50	295	65	28	300	60
3	6H8C	Operating voltage, V Selsyn repeater in 30° marker position	-140	-1 to-8 -85	-55 to -125 -135	-135 to -155	0	-55 to -125 -135
4	6H8C	Operating voltage, V Adjustment range of RELATION OF AMPL. MARKER screw	-130	225-240	0.5	0 to-8	205-225	6.5-8.5 8.5- 10.5- -0
10	6П3C	Operating voltage, V Selsyn repeater in 30° marker position		Filament	300	300	60-150 295	
7	6H8C	Operating voltage, V	0	265	13	0	180	7
8	6П3C	Operating voltage, V		Filament	300	300	0	
9	6П3C	Operating voltage, V		Filament	300	300	0	

SECRET

1	2	3	4	5	6	7	8	9	1
		Selsyn Repeater XA-01							
		I. Selsyn Repeater and Antenna Rotation Simulator Are Set into Rotation							
121	6H9C	Operating voltage, V		~300	65				Fi
5	5Ц4C	Operating voltage, V		~250		~260		~260	
1	6H9C	Operating voltage, V	0.1	-165	0.4	-0.25	60	0.4	Fi
		FINE CUT-OFF AMPL. adjusting screw							
		Minimum						0.4	
		Maximum						0.5	
		COARSE CUT-OFF AMPL. control							
		Minimum			0.5				
		Maximum			3.2				
2	6H9C	Operating voltage, V	-0.1	100	1.2	-(0.3-0.6)	110	1	F
3, 4	6П8C	Operating voltage, V		0	250	200	-(5-11)		F
		II. Selsyn Repeater and Antenna Rotation Simulator Are Not Set into Rotation							
121	6H9C	Operating voltage, V		300					F
5	5Ц4C	Operating voltage, V		250					
1	6П9C	Operating voltage, V	(18-0)	80	0.4-12	-1	80	0.4	F
2	6H9C	Operating voltage, V	-13	65-85	2-16	-1.8	120	0.7	F
3, 4	6П8C	Operating voltage, V		0	250	200	-40		F
		Range Marker Unit ДА-01							
26	6H8C	Operating voltage, V	40	200	0	105	300	120	F
		CHECK TRIGGER CUT-OFF adjusting screw							
		Minimum	0						
		Maximum	-140						
27	6H7C	Operating voltage, V	[illegible]	Filament	200	-20	-40	200	
		LENGTH OF CHECK screw							
		Minimum					38		
		Maximum					63		

3	4	5	6	7	8	9	10	11
Selsyn Repeater XA-01								
Selsyn Repeater and Antenna Rotation Simulator Are Set into Rotation								
ing voltage, V		300	65				Filament	0
ing voltage, V		250		~260		~260		250
ing voltage, V	0.1	65	0.4	-0.25	60	0.4	Filament	0
CUT-OFF AMPL.								
ng screw								
um						0.4		
um						0.5		
E CUT-OFF AMPL.								
um			0.5					
um			3.2					
ting voltage, V	-0.1	100	1.2	←(0.3-0.6)	110	1	Fi	
ting voltage, V		0	250	200	←(5-11)		F	
II. Selsyn Repeater and Antenna Rotation Simulator Are Not Set into Rotation								
ating voltage, V		300					F	
ating voltage, V		250						
ating voltage, V	(18-0)	80	0.4-12	-1	80	0.4	Fi	
ating voltage, V	-13	65-85	2-16	-1.8	120	0.7	Fil	
ating voltage, V		0	250	200	-40		Fil	
Range Marker Unit ZA-01								
rating voltage, V	40	200	0	105	300	120	Fila...	
CK TRIGGER CUT-OFF								
ting screw								
imum	0							
imum	-140							
rating voltage, V		Filament	200	-20	-40	200	Filament	0
GTH OF CHECK screw								
imum					38			
imum					63			

SECRET

4	5	6	7	8	9	10	11
-30 -20 -140	150	0	-70	150	-55	Filament	Filament
-70	300	0	-85 0 -150	-85	-70	Filament	Filament
	Filament	-30	-30	-35		Filament	-30
-30	300	0	-40	-27	-35	Filament	Filament
	Filament	240	-15	-9 -2 -9	175	Filament	0
-35 -150	300	-35	-30	300	-12	Filament	Filament
-30	150	0	-80	300	-80	Filament	Filament
-80	300	0	-100	-100	-80	Filament	Filament
	Filament	-40	-40	-55 -35 -150		Filament	-40
-40	300	0	-80	-40	-55	Filament	Filament
	Filament	280	-18	~0	140	Filament	0
-30	140	0	-70	300	-70	Filament	Filament

SECRET

1	2	3	4	5	6	7	8	9
28	6X6C	Operating voltage, V SWEEP CHECK SPEED Minimum Maximum		250			300	
29	6H8C	Operating voltage, V	40	300	47	-80	40	0
30	6X4	Operating voltage, V	0	Filament	6.5	0	6.5	300
31	6H8C	Operating voltage, V	60	220	60	45	230	55
2	6H8C	Operating voltage, V MARKER TRIGGER CUT-OFF screw Minimum Maximum	-45 0 -140	150	0	105	300	120
3	6H7C	Operating voltage, V LENGTH OF SCALE screw Minimum Maximum		Filament	150	-1.5	-50 -32 -52	270
4	6X6C	Operating voltage, V KIPP RELAY OF NEGATIVE PULSE screw Minimum Maximum		Filament	150	260	195 180 200	
5	6H7C	Operating voltage, V AMPLIT. SINE Minimum Maximum		Filament	300	-130 -120 -135	-130 -120 -135	300
6	6H8C	Operating voltage, V	-130	-130	-5	0	300	12
7	6H8C	Operating voltage, V COMPENS. OF DAMPED CIRCUIT adjusting screw Minimum Maximum	0	300	10	0	180	2 8 45
8	6X6C	Operating voltage, V		Filament	6	0	0	
9	6H8C	Operating voltage, V 2 KM. PULSE CUT-OFF adjusting screw Minimum Maximum	-6	150	0.15	-25 -20 -30	150	0

1	2	3	4	5	6	7	8	9	10	11
28	6X6C	Operating voltage, V SWEEP CHECK SPEED Minimum Maximum		250			300		250	320 320 340
29	6H8C	Operating voltage, V	40	300	47	-80	40	0	Filament	Filament
30	6Ж4	Operating voltage, V	0	Filament	6.5	0	6.5	300	Filament	180
31	6H8C	Operating voltage, V	60	220	60	45	230	55	Filament	Filament
2	6H8C	Operating voltage, V MARKER TRIGGER CUT-OFF screw Minimum Maximum	-45 0 -140	150	0	105	300	120	Filament	Filament
3	6H7C	Operating voltage, V LENGTH OF SCALE screw Minimum Maximum		Filament	150	-1.5	-50 -32 -52	270	Filament	0
4	6X6C	Operating voltage, V KIPP RELAY OF NEGATIVE PULSE screw Minimum Maximum		Filament	150	260	195 180 200		Filament	270
5	6H7C	Operating voltage, V AMPLIT. SINE Minimum Maximum		Filament	300	-130 -120 -135	-130 -120 -135	300	Filament	0
6	6H8C	Operating voltage, V	-130	-130	-5	0	300	12	Filament	Filament
7	6H8C	Operating voltage, V COMPENS. OF DAMPED CIRCUIT adjusting screw Minimum Maximum	0	300	10	0	180	5 8 45	Filament	Filament
8	6X6C	Operating voltage, V		Filament	6	0	0		Filament	8
9	6H8C	Operating voltage, V 2 KM. PULSE CUT-OFF adjusting screw Minimum Maximum	-6	150	0.15	-25 -20 -30	150	0	Filament	Filament

1	2	3	4	5	6	7	8	9	10	11
28	6X6C	Operating voltage, V SWEEP CHECK SPEED Minimum Maximum		250			300		250	320 320 340
29	6H8C	Operating voltage, V	40	300	47	-80	40	0	Filament	Filament
30	6X4	Operating voltage, V	0	Filament	6.5	0	6.5	300	Filament	180
31	6H8C	Operating voltage, V	60	220	60	45	230	55	Filament	Filament
2	6H8C	Operating voltage, V MARKER TRIGGER CUT-OFF screw Minimum Maximum	-45 0 -140	150	0	105	300	120	Filament	Filament
3	6H7C	Operating voltage, V LENGTH OF SCALE screw Minimum Maximum		Filament	150	-1.5	-50 -32 -52	270	Filament	0
4	6X6C	Operating voltage, V KIPP RELAY OF NEGATIVE PULSE screw Minimum Maximum		Filament	150	260	195 180 200		Filament	270
5	6H7C	Operating voltage, V AMPLIT. SINE Minimum Maximum		Filament	300	-130 -120 -135	-130 -120 -135	300	Filament	0
6	6H8C	Operating voltage, V	-130	-130	-5	0	300	12	Filament	Filament
7	6H8C	Operating voltage, V COMPENS. OF DAMPED CIRCUIT adjusting screw Minimum Maximum	0	300	10	0	180	5 8 45	Filament	Filament
8	6X6C	Operating voltage, V		Filament	6	0	0		Filament	8
9	6H8C	Operating voltage, V 2 KM. PULSE CUT-OFF adjusting screw Minimum Maximum	-6	150	0.15	-25 -20 -30	150	0	Filament	Filament

1	2	3	4	5	6	7	8	
[illegible]	6[illegible]C	Operating voltage, V SYNCHR. OF 100 KM. MARKER screw Minimum Maximum	-70	300	0	-80 0 -150	-80	
[illegible]	[illegible]	Operating voltage, V		Filament	-30	-30	-30	
[illegible]	[illegible]	Operating voltage, V	-27	300	0	-43	-25	
[illegible]	[illegible]	[illegible]erating voltage, V	-80	300	0	-50	300	
[illegible]	[illegible]	[illegible]ting voltage, V		Filament	290	-18	0	
[illegible]	[illegible]	[illegible] voltage, V [illegible]justing	-6	300	9	-55 -54 -77	300	
[illegible]	[illegible]	[illegible]tage, V [illegible]justing	-77 -55 -60	300	0	0	300	
[illegible]	[illegible]	[illegible]ltage, V [illegible] TRIGGER [illegible]ng screw [illegible] [illegible] [illegible] TRIGGER CUT- [illegible] [illegible]nimum [illegible] Maximum	-15 -10 -140	300	0	-72 -10 -130	300	
[illegible]	[illegible]	[illegible]erating voltage, V ([illegible]ode cap - 950 V)		About 1000				
[illegible]	[illegible]	Operating voltage, V INDICATOR TRIGGER CUT-OFF adjusting screw Minimum Maximum		Filament	300	-72 -10 -130	-72 -10 -130	3[illegible]

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1	2	3	4	5	6	7	8	
	6H8C	Operating voltage, V SYNCHR. OF 100 KM. MARKER screw Minimum Maximum	-70	300	0	-80 0 -150	-80	
		Operating voltage, V		Filament	-30	-30	-30	
		Operating voltage, V	-27	300	0	-43	-25	
		Operating voltage, V	-80	300	0	-50	300	
		Operating voltage, V		Filament	290	-18	0	
		Operating voltage, V [illegible]V. II adjusting [illegible] Minimum Maximum	-8	300	9	-55 -54 -57	300	
		[illegible]ting voltage, V [illegible]. III adjusting Minimum Maximum	-57 -55 -60	300	0	0	300	
		Operating voltage, V SYNCHR. OF TRIGGER [illegible] adjusting screw Minimum Maximum INDICATOR TRIGGER CUT- OFF screw Minimum Maximum	-15 -10 -140	300	0	-72 -10 -130	300	
	[illegible]C	Operating voltage. V (anode cap - 950 V)		About 1000				
	6H7C	Operating voltage, V INDICATOR TRIGGER CUT- OFF adjusting screw Minimum Maximum		Filament	300	-72 -10 -130	-72 -10 -130	3

2	3	4	5	6	7	8	9	10	11
6H8C	Operating voltage, V SYNCHR. OF 100 KM. MARKER screw	-70	300	0	-80	-80	-70	Filament	Filament
	Minimum				0				
	Maximum				-150				
6X6C	Operating voltage, V		Filament	-30	-30	-30		Filament	-30
6H8C	Operating voltage, V	-27	300	0	-43	-25	-30	Filament	Filament
6H8C	Operating voltage, V	-80	300	0	-50	300	0	Filament	Filament
6H7C	Operating voltage, V		Filament	290	-18	0	140	Filament	0
6H8C	Operating voltage, V DIV. II adjusting screw	-8	300	9	-55	300	0	Filament	Filament
	Minimum				-54				
	Maximum				-57				
6H8C	Operating voltage, V DIVIS. III adjusting screw	-57	300	0	0	300	0	Filament	Filament
	Minimum	-55							
	Maximum	-60							
6H8C	Operating voltage, V SYNCHR. OF TRIGGER PULSE adjusting screw	-15	300	0	-72	300	0	Filament	Filament
	Minimum	-10							
	Maximum	-140							
	INDICATOR TRIGGER CUT-OFF screw								
	Minimum				-10				
	Maximum				-130				
2II2C	Operating voltage, V (anode cap - 950 V)		About 1000					About 1000	
6H7C	Operating voltage, V INDICATOR TRIGGER CUT-OFF adjusting screw		Filament	300	-72	-72	300	Filament	0
	Minimum				-10	-10			
	Maximum				-130	-130			

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SECRET

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Plan Position Indicator ПО-02

3	4	5	6	7	8	9	10	11
LAY CUT-IN screw,								
switch								
80 KM.	-32	300	0	120	300	160	Filament	95
200 KM.	-32	300	0	80	300	100	Filament	95
400 KM.	-32	300	0	80	300	100	Filament	95
IGGER CUT-OFF screw								
Minimum	-10							
Maximum	-150							
LAY CUT-OUT screw,								
switch								
80 KM.	-32	220	0	125	300	160	Filament	95
200 KM.	-32	160	0	85	300	100	Filament	95
400 KM.	-32	160	0	85	300	100	Filament	95
IGGER CUT-OFF screw								
Minimum	-10							
Maximum	-150							
LAY CUT-OUT screw,								
switch								
80 KM.		Filament	220	-32	-20	215	Filament	0
200 KM.		Filament	160	-30	-50	295	Filament	0
400 KM.		Filament	160	-30	-50	295	Filament	0
LAY CUT-IN screw								
80 KM.				-28				
200 KM.				-26				
400 KM.				-26				
GTH OF SWEEP screw								
um 80 KM.					-10			
200 KM.					-35			
400 KM.					-35			
um 80 KM.					-30			
200 KM.					-55			
400 KM.					-55			
LE switch								
80 KM.		Filament	220	260	100		Filament	215
200 KM.		Filament	160	260	100		Filament	295
400 KM.		Filament	160	260	100		Filament	295

SECRET

1	2	3	4	5	6	7	8	9	10
7	6X6C	NEGATIVE PULSE screw:							
		Minimum 80 KM.				190			
		Minimum 200 KM.				190			
		Minimum 400 KM.				190			
		Maximum 80 KM.				310			
		Maximum 200 KM.				310			
		Maximum 400 KM.				310			
		POSITIVE PULSE screw:							
		Minimum 80 KM.					100		
		Minimum 200 KM.					100		
		Minimum 400 KM.					100		
		Maximum 80 KM.					190		
		Maximum 200 KM.					190		
		Maximum 400 KM.					190		
9	6H7C	SCALE switch:							
		80 KM.		Filament	8	-56	-56	100	Filament
		200 KM.		Filament	22	-100	-100	125	Filament
		400 KM.		Filament	10	-100	-100	110	Filament
		SCALE ADJUSTMENT screw (depends on its length):							
		Minimum 80 KM.			7				
		Minimum 200 KM.			17				
		Minimum 400 KM.			9				
		Maximum 80 KM.			15				
		Maximum 200 KM.			42				
		Maximum 400 KM.			21				
10	6X6C	SCALE switch:							
		80 KM.		230	310	310	300		Filament
		200 KM.		230	325	325	300		Filament
		400 KM.		230	320	320	300		Filament
		SCALE ADJUSTMENT screw:							
		Minimum 80 KM.				310			
		Minimum 200 KM.				325			
		Minimum 400 KM.				310			
		Maximum 80 KM.				320			
		Maximum 200 KM.				350			
		Maximum 400 KM.				330			

3	4	5	6	7	8	9	10	11
NEGATIVE PULSE screw:								
Minimum 80 KM.				190				
Minimum 200 KM.				190				
Minimum 400 KM.				190				
Maximum 80 KM.				310				
Maximum 200 KM.				310				
Maximum 400 KM.				310				
POSITIVE PULSE screw:								
Minimum 80 KM.					100			
Minimum 200 KM.					100			
Minimum 400 KM.					100			
Maximum 80 KM.					190			
Maximum 200 KM.					190			
Maximum 400 KM.					190			
SCALE switch:								
80 KM.		Filament	8	-56	-56	100	Filament	0
200 KM.		Filament	22	-100	-100	125	Filament	0
400 KM.		Filament	10	-100	-100	110	Filament	0
SCALE ADJUSTMENT screw (depends on its length):								
Minimum 80 KM.			7					
Minimum 200 KM.			17					
Minimum 400 KM.			9					
Maximum 80 KM.			15					
Maximum 200 KM.			42					
Maximum 400 KM.			21					
SCALE switch:								
80 KM.		230	310	310	300		Filament	310
200 KM.		230	325	325	300		Filament	330
400 KM.		230	320	320	300		Filament	320
SCALE ADJUSTMENT screw:								
Minimum 80 KM.				310				
Minimum 200 KM.				325				
Minimum 400 KM.				310				
Maximum 80 KM.				320				
Maximum 200 KM.				350				
Maximum 400 KM.				330				

3	4	5	6	7	8	9	10	11
LE switch:								
80 KM.	8	190	20	-4	80	0.5	Filament	Filament
200 KM.	22	190	30	-3	125	0.5	Filament	Filament
400 KM.	10	190	25	-3	110	0.5	Filament	Filament
LE ADJUSTMENT screw nds on length):								
um { 80 KM.	6							
200 KM.	17							
400 KM.	9							
um { 80 KM.	15							
200 KM.	42							
400 KM.	21							
[illegible]		Filament	-80	-55	-80		Filament	-55
[illegible]		Filament	-80	-10	-80		Filament	-10
[illegible]		Filament	-80	-30	-80		Filament	-30
[illegible]		Filament	300	300	-55		Filament	10
[illegible]		Filament	300	300	-10		Filament	20
[illegible]		Filament	300	300	-30		Filament	15
[illegible]t-								
[illegible]								9
200								18
400								16
80								11
200 KM.								20
400 KM.								17
LE switch:								
80 KM.		Filament	300	300	-55		Filament	10
200 KM.		Filament	300	300	-10		Filament	20
400 KM.		Filament	300	300	-30		Filament	15
EP CURRENT screw:								
um { 80 KM.								9
200 KM.								18
400 KM.								16

1	2	3	4	5	6	7	8	
I4	6П3C	Maximum { 80 KM. / 200 KM. / 400 KM.						
15	6H8C	SCALE MARKER CUT-IN switch	70	300	90	95	300	
		SCALE MARKER CUT-OUT switch		300	18	0	300	
16	6X6C	SCALE MARKER CUT-IN switch		Filament	90	100	105	
		SCALE MARKER CUT-OUT switch		Filament	17	100	15	
17	6Ж4	SCALE MARKER CUT-IN switch		Filament	100	100	100	2
		SCALE MARKER CUT-OUT switch		Filament	100	95	100	2
18	6H8C	SCALE MARKER CUT-IN switch	1	1	4	4	300	1
		BRIGHTNESS knob:						
		Minimum	40					
		Maximum	-150					
		SCALE MARKER CUT-OUT switch	1	1	4	4	300	1
		BRIGHTNESS knob:						
		Minimum	40					
		Maximum	-150					
19, 20, 21	6Ж4	Channels ON		Filament	4	-1.6	4	250
		CHANNEL AMPLIFICATION adjusting screw:						
		Minimum					0.5	
		Maximum					4	
		Channels OFF		Filament	0	-50	0	300
25	6П8C	Channels ON	40	40	40	40	300	50
		Channels OFF	40	40	40	40	300	50
26	6H3C	CENTRE DISPLACEMENT ON switch:						
		80 KM.		Filament	240	275	25	
		200 KM.		Filament	240	275	25	
		400 KM.		Filament	240	275	25	

SECRET

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2	3	4	5	6	7	8	9	10	11
6П3C	Maximum 80 KM.								11
	200 KM.								20
	400 KM.								17
6H8C	SCALE MARKER CUT-IN switch	70	300	90	95	300	105	Filament	Filament
	SCALE MARKER CUT-OUT switch		300	18	0	300	15	Filament	Filament
6X6C	SCALE MARKER CUT-IN switch		Filament	90	100	105		Filament	105
	SCALE MARKER CUT-OUT switch		Filament	17	100	15		Filament	100
6Ж4	SCALE MARKER CUT-IN switch		Filament	100	100	100	240	Filament	260
	SCALE MARKER CUT-OUT switch		Filament	100	95	100	235	Filament	260
6H8C	SCALE MARKER CUT-IN switch	1	1	4	4	300	10	Filament	Filament
	BRIGHTNESS knob:								
	Minimum	40							
	Maximum	-150							
	SCALE MARKER CUT-OUT switch	1	1	4	4	300	10	Filament	Filament
	BRIGHTNESS knob:								
	Minimum	40							
	Maximum	-150							
6Ж4	Channels ON		Filament	4	-1.6	4	250	Filament	220 changes depending on AMPL. ECHO
	CHANNEL AMPLIFICATION adjusting screw:								
	Minimum					0.5			
	Maximum					4			
	Channels OFF		Filament	0	-50	0	300	Filament	300
6H8C	Channels ON	40	40	40	40	300	50	Filament	Filament
	Channels OFF	40	40	40	40	300	50	Filament	Filament
6П3C	CENTRE DISPLACEMENT ON switch:								
	80 KM.		Filament	240	275	25		Filament	65
	200 KM.		Filament	240	275	25		Filament	65
	400 KM.		Filament	240	275	25		Filament	65

SECRET

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3	4	5	6	7	8	9	10	[illegible]
CENTRE DISPLACEMENT knob:								
Minimum					50			0
Maximum					-150			65
CENTRE DISPLACEMENT OFF switch:								
80 KM.		Filament	300	300	-150		Filament	0
200 KM.		Filament	300	300	-150		Filament	0
400 KM.		Filament	300	300	-150		Filament	0
FOCUS knob:								
Minimum					0			
Maximum					-50			
SCALE switch:								
80 KM.		Filament	60	60	-200		Filament	-150
200 KM		Filament	260	260	-250		Filament	-155
400 KM.		Filament	260	260	-250		Filament	-155
DELAY CUT-IN adjusting screw, SCALE switch								
80 KM.	30	Filament	35	55	30	30	Filament	25
200 KM.	30	Filament	35	50	30	30	Filament	25
400 KM.	30	Filament	35	50	30	30	Filament	25
DELAY knob:								
Minimum 80 KM.	15		40	50	10			25
Minimum 200 KM.	25		40	50	25			25
Minimum 400 KM.	25		40	50	25			25
Maximum 80 KM.	30		125	60	30			30
Maximum 200 KM.	35		90	55	30			25
Maximum 400 KM.	35		90	55	30			25
DELAY CUT-OUT adjusting screw, SCALE switch:								
80 KM.	30	Filament	40	50	30	30	Filament	25
200 KM.	30	Filament	40	50	30	30	Filament	25
400 KM.	30	Filament	40	50	30	30	Filament	25

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SECRET [redacted] 50X1-HUM

1	2	3	4	5	6	7	8	9	10
2	6A7	DELAY knob:							
		Minimum 80 KM.			40				
		Minimum 200 KM.			40				
		Minimum 400 KM.			40				
		Maximum 80 KM.			220				
		Maximum 200 KM.			110				
		Maximum 400 KM.			110				
[illegible]	[illegible]	DELAY CUT-IN adjusting screw, SCALE switch:							
		80 KM.	35	300	70	35	35	65	Filam
		200 KM.	35	300	65	35	35	55	Filam
		400 KM.	35	300	60	35	35	50	Filam
		DELAY knob:							
		Minimum 80 KM.	40			40	40	35	
		Minimum 200 KM.	40			40	40	35	
		Minimum 400 KM.	40			40	40	35	
		Maximum 80 KM.	125			125	125	210	
		Maximum 200 KM.	90			90	90	105	
		Maximum 400 KM.	90			90	90	105	
		DELAY CUT-OUT adjusting screw, SCALE switch:							
		80 KM.	65	300	75	65	65	65	Filame
		200 KM.	55	300	65	55	55	55	Filame
		400 KM.	50	300	60	50	50	50	Filame
		DELAY knob:							
		Minimum 80 KM.	35		50	35	35	35	
		Minimum 200 KM.	35		50	35	35	35	
		Minimum 400 KM.	35		50	35	35	35	
		Maximum 80 KM.	140		205	140	140	210	
		Maximum 200 KM.	110		115	110	110	105	
		Maximum 400 KM.	110		115	110	110	105	
4	6H7C	DELAY CUT-IN adjusting screw (potentiometer is cut out). SCALE potentiometer:							

3	4	5	6	7	8	9	10	11
DELAY knob:								
Minimum 80 KM.			40					
Minimum 200 KM.			40					
Minimum 400 KM.			40					
Maximum 80 KM.			220					
Maximum 200 KM.			110					
Maximum 400 KM.			110					
DELAY CUT-IN adjusting screw, SCALE switch:								
80 KM.	35	300	70	35	35	65	Filament	Filament
200 KM.	35	300	65	35	35	55	Filament	Filament
400 KM.	35	300	60	35	35	50	Filament	Filament
DELAY knob:								
Minimum 80 KM.	40			40	40	35		
Minimum 200 KM.	40			40	40	35		
Minimum 400 KM.	40			40	40	35		
Maximum 80 KM.	125			125	125	210		
Maximum 200 KM.	90			90	90	105		
Maximum 400 KM.	90			90	90	105		
DELAY CUT-OUT adjusting screw, SCALE switch:								
80 KM.	65	300	75	65	65	65	Filament	50
200 KM.	55	300	65	55	55	55	Filament	50
400 KM.	50	300	60	50	50	50	Filament	50
DELAY knob:								
Minimum 80 KM.	35		50	35	35	35		10
Minimum 200 KM.	35		50	35	35	35		10
Minimum 400 KM.	35		50	35	35	35		10
Maximum 80 KM.	140		205	140	140	210		110
Maximum 200 KM.	110		115	110	110	105		55
Maximum 400 KM.	110		115	110	110	105		55
DELAY CUT-IN adjusting screw (potentiometer is cut out). SCALE potentiometer:								

3	4	5	6	7	8	9	10	11
80 KM.		Filament	115	-0.2	-10	300	Filament	0
200 KM.		Filament	115	-0.2	-10	300	Filament	0
400 KM.		Filament	115	-0.2	-10	300	Filament	0
RIGGER CUT-ting screw:								
mum					-10			
mum					-20			
UT-OUT adjust-:								
80 KM.		Filament	115	-0.2	-10	300	Filament	0
200 KM.		Filament	115	-0.2	-10	300	Filament	0
400 KM.		Filament	115	-0.2	-10	300	Filament	0
witch:								
80 KM.		6.2	60		10		50	6.2
200 KM.		6.2	260		10		50	6.2
400 KM.		6.2	260		10		50	6.2
ESS knob:								
mum					50			
mum					-135			
Range and Azimuth Indicator BO-01								
witch:								
50 KM.	-(70-20)	300	0	125-165	300	190-215	Filament	45
100 KM.	-(70-20)	300	0	115-170	300	175-215	Filament	45
CUT-OFF								
mum		-115						
mum		-55-5						
witch:								
50 KM.		Filament	300-270	-(30-36)	2 to -10	125-155	Filament	0
100 KM.		Filament	300-260	-(24-31)	-(18-0)	135-175	Filament	0
OF SWEEP screw:								
mum					2 to -8			
mum					0 to 26			

1	2	3	4	5	6	7	8	9	
9	6H7C	SCALE switch: 50 KM. 100 KM. SCALE ADJUSTMENT screw: Minimum 50 KM. Maximum 50 KM. Minimum 100 KM. Maximum 100 KM.		 Filament Filament	 0.4-2 0.4-3 (0.6-3) (0.4-2) (0.55-4.5) (0.4-3)	 -(0-20) -(0-40)	 -(0-20) -(0-40)	 50-60 50-70	 Fil Fil
10	6X6C	SCALE switch: 50 KM. 100 KM.		 250 250	 300 300	 310 310	 300 300		 Fil Fil
11	6H8C	SCALE switch: 50 KM. 100 KM.	 0.4-2 0.4-3	 200 200	 7.8-9.2 7.8-10	 0.6-1.4 0.2-1.65	 50-60 50-70	 0.3 0.3	 Fil Fil
12	6X6C	SCALE switch: 50 KM. 100 KM.		 Filament Filament	 -80 -80	 -40 -40	 -80 -80		 Fil Fil
13	6П3C	SCALE switch: 50 KM. 100 KM. SWEEP CURRENT screw: Minimum 50 KM. Maximum 50 KM. Minimum 100 KM. Maximum 100 KM.		 Filament Filament	 300 300	 300 300	 -(70-76.5) -(62-76.5)		 Fil Fil
14	6П3C	SCALE switch: 50 KM. 100 KM. HORIZONTAL SHIFT screw: Minimum Maximum		 Filament Filament	 295 295	 300 300	 100 100 0 195		 Fil Fil
34	6П3C	SCALE switch: 50 KM. 100 KM.		 Filament Filament	 160 160	 230 230	 -23 -23		 Fil Fil

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50X1-HUM

3	4	5	6	7	8	9	10	11
SCALE switch:								
50 KM.		Filament	0.4-2	-(0-20)	-(0-20)	50-60	Filament	0
100 KM.		Filament	0.4-3	-(0-40)	-(0-40)	50-70	Filament	0
SCALE ADJUSTMENT screw:								
Minimum 50 KM.			(0.6-3)					
Maximum 50 KM.			(0.4-2)					
Minimum 100 KM.			(0.55-4.5)					
Maximum 100 KM.			(0.4-3)					
SCALE switch:								
50 KM.		250	300	310	300		Filament	310
100 KM.		250	300	310	300		Filament	310
SCALE switch:								
50 KM.	0.4-2	200	7.8-9.2	0.6-1.4	50-60	0.3	Filament	Filament
100 KM.	0.4-3	200	7.8-10	0.2-1.65	50-70	0.3	Filament	Filament
SCALE switch:								
50 KM.		Filament	-80	-40	-80		Filament	-40
100 KM.		Filament	-80	-40	-80		Filament	-40
SCALE switch:								
50 KM.		Filament	300	300	-(70-76.5)		Filament	0.4-1.8
100 KM.		Filament	300	300	-(62-76.5)		Filament	0.4-2.8
SWEEP CURRENT screw:								
Minimum 50 KM.								(0.2-1.6)
Maximum 50 KM.								(0.8-2.2)
Minimum 100 KM.								(0.2-2.4)
Maximum 100 KM.								(0.8-3)
SCALE switch:								
50 KM.		Filament	295	300	100		Filament	110
100 KM.		Filament	295	300	100		Filament	110
HORIZONTAL SHIFT screw:								
Minimum					0			
Maximum					195			
SCALE switch:								
50 KM.		Filament	160	230	-23		Filament	4.8
100 KM.		Filament	160	230	-23		Filament	4.8

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3	4	5	6	7	8	9	10	11
US knob:								
Minimum					0			
Maximum					-55			
LE switch:								
50 KM.		Filament	-(17-27)	-(17-27)	-(145-165)		Filament	-35
100 KM.		Filament	(-27-27)	(-27-27)	-(145-180)		Filament	-35
KER.ON switch,								
switch:								
50 KM.	85	300	90	90	300	95	Filament	Filament
100 KM.	85	300	90	90	300	95	Filament	Filament
GE MARKER CUT-OFF								
ting screw:								
Minimum	57							
	95							
				57				
				95				
	0	300	14	0	300	15	Filament	Filament
	0	300	14	0	300	15	Filament	Filament
50 KM.		Filament	90	96	96		Filament	96
00 KM.		Filament	90	96	96		Filament	96
KER OFF switch,								
switch:								
50 KM.		Filament	14	96	15		Filament	96
100 KM.		Filament	14	96	15		Filament	96
LE switch:								
50 KM.		Filament	96	95	96	240	Filament	260
100 KM.		Filament	96	95	96	240	Filament	260

3	4	5	6	7	8	9	10	11
SCALE switch:								
50 KM.	3.5	3.5	4.2	4.2	300	13	Filament	Filament
100 KM.	3.5	3.5	4.2	4.2	300	13	Filament	Filament
BRIGHTNESS knob:								
Minimum	-145							
Maximum	44							
ECHO-VERTIC. OFF, ECHO-SLANT OFF switches, SCALE switch:								
50 KM.		Filament	0	-4.7	0	300	Filament	300
100 KM.		Filament	0	-4.7	0	300	Filament	300
ECHO-VERTIC. ON, ECHO-SLANT ON switches, SCALE switch:								
50 KM.		Filament	3.8	-1.5	3.8	250	Filament	220
100 KM.		Filament	0.5	-1.5	0.5	150	Filament	90
SCALE switch:								
50 KM.	42	42	37	42	300	50	Filament	Filament
100 KM.	42	42	37	42	300	50	Filament	Filament
SCALE switch:								
50 KM.	100	300	100	0.7	300	28	Filament	Filament
RESOLVER SHIFTING screw:								
Minimum	70							
Maximum	200							
SCALE switch:								
50 KM.	-45-75	100	40-150	10.5-12.5	40-150	100	Filament	74
SCALE switch:								
50 KM.	50-160	300	55-160				Filament	Filament
SCALE switch:								
50 KM.		Filament	200-300	70-130	0-85-120	300-200	Filament	120-90
LOWER BLANKING LEVEL screw:								
Minimum					44-30-38			
Maximum					10-110-135			

	4	5	6	7	8	9	10	11
LEVEL		Filament	300-200	70-160	75-140-170 45-118-145 90-140-170	220-300	Filament	128-158
		Filament	0	0.2	0		Filament	0.2
		Filament	280-120	0 to-43	0 to-42	120-260	Filament	0
		Filament	300-280	300	65-160		Filament	85-155
crew:		Filament	300-280	300	130-105 65		Filament	80-92
:	31 14	Filament Filament	35 140	48 64	34 12	31 14	Filament Filament	25 32
:	35 140	300 300	48 130	35 140	35 140	35 230	Filament Filament	35 230
UT-OFF		Filament	120	-0.4	-11 -21 -10	300	Filament	0
		6.2 6.2	-(17-27) -27 to +27		13 13		50 50	6.2 6.2

1	2	3	4	5	6	7	8	9	10
				Supply Unit БП-02					
1,2	5Ц3С	Operating voltage, V		600		~565		~565	
3,4	5Ц3С	Operating voltage, V		670		~565		~565	
5	5Ц3С	Operating voltage, V		260		~185		~185	
6,7 8,9, 10, 11, 28, 29	6П3С	Operating voltage, V		Filament	600	600	270		Filame
13	6П3С	Operating voltage, V		Filament	300	300	160		Filame
14	6Н8С	Operating voltage, V	75	300	85	75	300	85	Filame
15	6Ж4	Operating voltage, V ADJUSTMENT +300 V screw: Minimum Maximum		Filament	0	-1.65 -1.7 -1.6	0	77	Filame
16	6Ж4	Operating voltage, V		Filament	1.6	0	1.6	77	Filamen
17, 18	6П3С	Operating voltage, V		Filament	240	240	-20		Filamen
				Antenna Rotation Simulator ИВ-0I					
12	6Н8С	Operating voltage, V	50	265	58.5	30	265	54	Filamen
13	6Н8С	Operating voltage, V AMPLIT. 1500 c.p.s. control: Minimum Maximum	0 to~15 ~5 ~40	230	12	0.05	158	5.8	Filamen
14, 15	6П3С	Operating voltage, V		Filament	260	260	0.08		Filament
16	5Ц4С	Operating voltage, V		280		~220		~220	

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2	3	4	5	6	7	8	9	10	11
	Supply Unit БП-02								
Ц3С	Operating voltage, V		600		~565		~565		600
Ц3С	Operating voltage, V		670		~565		~565		670
Ц3С	Operating voltage, V		260		~185		~185		260
Ц3С	Operating voltage, V		Filament	600	600	270		Filament	300
Ц3С	Operating voltage, V		Filament	300	300	160		Filament	175
Н8С	Operating voltage, V	75	300	85	75	300	85	Filament	Filament
Ж4	Operating voltage, V ADJUSTMENT +300 V screw: Minimum Maximum		Filament	0	-1.65 -1.7 -1.6	0	77	Filament	160
4	Operating voltage, V		Filament	1.6	0	1.6	77	Filament	75
3С	Operating voltage, V		Filament	240	240	-20		Filament	0
	Antenna Rotation Simulator ИВ-01								
8С	Operating voltage, V	50	265	58.5	30	265	54	Filament	Filament
8С	Operating voltage, V AMPLIT. 1500 c.p.s. control: Minimum Maximum	0 to ~15 ~5 ~40	230	12	0.05	158	5.8	Filament	Filament
3С	Operating voltage, V		Filament	260	260	0.08		Filament	25
4С	Operating voltage, V		280		~220		~220		280

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2	3	4	5	6	7	8	9	10	11
	Power Supply Unit БП-01 Loaded with Plan Position Indicator ИО-02								
П3С	Operating voltage, V		620		~550		~550		620
П3С	Operating voltage, V		620		~550		~550		620
П3С	Operating voltage, V		280		~170		~170		280
П3С	Operating voltage, V		Filament	600	600	300		Filament	300
П8С	Operating voltage, V		Filament	240	175	-13		Filament	0
8С	Operating voltage, V	125	300	80	70	300	80	Filament	Filament
02-20	Operating voltage, kV (Anode cap 7.4 kV)	7.4 kV			7.4				
С-I	Operating voltage, V		Filament	600		240	260		Filament
С	Operating voltage, V ADJUSTMENT +5.5 kV screw: Minimum Maximum	0	240	3	-0.1 -5.6 +4	260	3	Filament	Filament
	...g voltage, V		Filament	3.5	0	3.5	75	Filament	125
	...g voltage, V		Filament	300	300	160		Filament	175
	...rating voltage, V ...MENT +300 V screw: ...nimum ...ximum		Filament	0	-1.6 -0.8 -1.8	0	75	Filament	160
	Height Indicator НО-02								
	Operating voltage, V TRIGGER CUT-OFF screw: Minimum Maximum	-45 8 -90	225	0	122	300	142	Filament	85
C	Operating voltage, V LENGTH OF HORIZONTAL SWEEP adjusting screw: Minimum Maximum		Filament	225	-27.5	-33 -39 -11	25	Filament	0

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1	2	3	4	5	6	7	8	9	
9	6H6C	Operating voltage, V		Filament	8.5	-70	-70	85	F
10	6X6C	Operating voltage, V HORIZONTAL SWEEP SCALE adjusting screw: Minimum Maximum		280	300	310	300		F
11	6H8C	Operating voltage, V	8.5	185	15	-3	85	0.4	F
12	6X6C	Operating voltage, V		Filament	-75	-40	-75	-40	F
13	6П3C	Operating voltage, V HORIZONTAL SWEEP CURRENT screw: Minimum Maximum		Filament	290	300	-40		F
14	6П3C	Operating voltage, V HORIZONTAL SHIFT screw: Minimum Maximum		Filament	285	300	140 0 180		Fi
15	6H8C	Operating voltage, V ANGLE MARKER CUT-OFF adjusting screw: Minimum Maximum	75	300	85	60 48 85	300	75	Fi
16	6X6C	Operating voltage, V		Filament	85	90	75		Fil
17	6Ж4	Operating voltage, V		Filament	95	95	95	245	Fil
18	6H8C	Operating voltage, V BRIGHTNESS knob: Minimum Maximum	-28 30 -150	-28	-28	-28	300	-15	Fil
20	6Ж4	Operating voltage, V VERT.ECHO AMPL. screw: Minimum Maximum		Filament	0-2.6 6-0.6 3.4-6	-48 to -0.5	0-2.6	230-300	Fila
21	6Ж4	Operating voltage, V SLANT ECHO AMPL. screw: Minimum Maximum		Filament	0-2.2 3-6 6-6.5	-1.5;to -42	0.22	300-240	Fila

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SECRET

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3	4	5	6	7	8	9	10	11
Operating voltage, V		Filament	8.5	-70	-70	85	Filament	0.1
Operating voltage, V HORIZONTAL SWEEP SCALE adjusting screw: Minimum Maximum		280	300	310	300		Filament	310 305 310
Operating voltage, V	8.5	185	15	-3	85	0.4	Filament	Filament
Operating voltage, V		Filament	-75	-40	-75	-40	Filament	
Operating voltage, V HORIZONTAL SWEEP CURRENT screw: Minimum Maximum		Filament	290	300	-40		Filament	75 7 8
Operating voltage, V HORIZONTAL SHIFT screw: Minimum Maximum		Filament	285	300	140 0 180		Filament	145
Operating voltage, V ANGLE MARKER CUT-OFF adjusting screw: Minimum Maximum	75	300	85	60 48 85	300	75	Filament	Filament
Operating voltage, V		Filament	85	90	75		Filament	90
Operating voltage, V		Filament	95	95	95	245	Filament	270
Operating voltage, V BRIGHTNESS knob: Minimum Maximum	-28 30 -150	-28	-28	-28	300	-15	Filament	Filament
Operating voltage, V VERT.ECHO AMPL. screw: Minimum Maximum		Filament	0-2.6 0-0.6 3.4-0	-48 to-0.5	0-2.6	230-300	Filament	275-270
Operating voltage, V SLANT ECHO AMPL. screw: Minimum Maximum		Filament	0-2.2 3-0 0-0.5	-1.5;to -42	0.22	300-240	Filament	270-275

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3	4	5	6	7	8	9	10	11
Operating voltage, V	-50;-4	300	-50;-40	-50;-40	-50;-40	-48; -2	Filament	Filament
Operating voltage, V	-45;-4	-45;-4	-3;-43	-6; -47	300	-45; -4	Filament	Filament
Operating voltage, V		Filament	44;0	0	48;0		Filament	0
SLANT ECHO SHIFT adjusting screw:								
Minimum			0;41					
Maximum			0;46					
VERT.ECHO SHIFT adjusting screw:								
Minimum					0;46			
Maximum					0;50			
Operating voltage, V	35	35	35	35	295	45	Filament	Filament
Operating voltage, V	-23.5	300	-13	0.6	300	23	Filament	Filament
HORIZON LINE SHIFT adjusting screw:								
Minimum	0							
Maximum	-52							
Operating voltage, V	-210;-15	-13	-110;85	-120	-110;85	-13	Filament	Filament
Operating voltage, V	56; -24	105;255	58;15	40;-78	230;75	58;15	Filament	Filament
Operating voltage, V		Filament	145	215	-20		Filament	4.4
Operating voltage, V		Filament	3	27	3		Filament	27
LENGTH OF BRIGHTNESS adjusting screw:								
Minimum				55				55
Maximum				0.1				0.1
Operating voltage, V	-3.5	280	0	-0.45	170	0	Filament	Filament
Operating voltage, V	-4	300	7	7	7	8.5	Filament	Filament
VERT. SWEEP SPEED adjusting screw:								
Minimum						8		
Maximum						9		
Operating voltage, V	0.15	Filament		-70	0.15	38	Filament	3
Operating voltage, V		Filament	100	100	-210		Filament	-140
Operating voltage, V	3	185	10	-1	90	0.5	Filament	Filament
Operating voltage, V		Filament	-1	0	-45		Filament	-35
Operating voltage, V		Filament	300	300	37-17		Filament	1-12

		4	5	6	7	8	9	
73								
			Filament	280	300	140 190 0		Fi
			Filament	300;220	90-90	-30 to 90 80-40 120-15	300-230	Fi
	V EL		Filament	300;205	90-90	-55 to 45 -60-60 -50-90	300-230	Fi
	...tage, V		Filament	0	0.5	0		Fi
	...ltage, V		Filament	280-120	0 to -36	0 to -32	120-290	Fi
	...voltage, V		Filament	145	215	-20		Fi
	...g voltage, V		Filament	-35 to 100		-15		
	Antenna Turn Angle Marker Unit 3A-01							
	Operating voltage, V ANGLE ACCURACY screw: Minimum Maximum		Filament	1.6 0 4	70	1.6 0 4		Fil
...4	Operating voltage, V		Filament	0	-0.2	0	100	Fil
6X4	Operating voltage, V ANGLE PULSE screw: Minimum Maximum TRIGGER CUT-OFF screw: Minimum Maximum		Filament	-68 0 -140	-33 0 -145	0	200	Fil

2	3	4	5	6	7	8	9	10	11
6П3C	SWEEP CURRENT screw:								
	Minimum								0.5-9.5
	Maximum								9.5-13
П3C	Operating voltage, V		Filament	280	300	140		Filament	150
	VERT. SHIFT screw:								
	Minimum					190			
	Maximum					0			
7C	Operating voltage, V		Filament	300;220	90-90	-30 to 90	300-230	Filament	100-50
	UPPER BLANKING LEVEL screw:								
	Minimum					80-40			
	Maximum					120-15			
7C	Operating voltage, V		Filament	300;205	90-90	-55 to 45	300-230	Filament	2-90
	LOWER BLANKING LEVEL screw:								
	Minimum					-60-60			
	Maximum					-50-90			
X6	Operating voltage, V		Filament	0	0.5	0		Filament	0.5
7C	Operating voltage, V		Filament	280-120	0 to -36	0 to-32	120-290	Filament	0
6C	Operating voltage, V		Filament	145	215	-20		Filament	4.4
ode-tube 432	Operating voltage, V		Filament	-35 to 100	-	-15		45	Filament

Antenna Turn Angle Marker Unit 3A-01

2	3	4	5	6	7	8	9	10	11
K6C	Operating voltage, V		Filament	1.6	70	1.6		Filament	70
	ANGLE ACCURACY screw:								
	Minimum			0		0			
	Maximum			4		4			
4	Operating voltage, V		Filament	0	-0.2	0	100	Filament	30
4	Operating voltage, V		Filament	-68	-33	0	200	Filament	285
	ANGLE PULSE screw:								
	Minimum			0					
	Maximum			-140					
	TRIGGER CUT-OFF screw:								
	Minimum				0				
	Maximum				-145				

3	4	5	6	7	8	9	10	11
ing voltage, V LENGTH screw: Minimum Maximum		Filament	290	-44	0.8 0.5 1.8	80	Filament	0
ing voltage, V LENGTH control: Minimum Maximum		Filament	0.8 0.5 1.7	17	0.8		Filament	17
ng voltage, V AMPLIT. screw: Minimum aximum	-145 -140 -145	300	-120	-120	300	0.2	Filament	Filament
	Servo Amplifier YC-02							
ng voltage, V READING AMPLIF. inimum ximum ADING AMPLIF. nimum ximum	0-0.2	60	0.4 0.4 4	-0.25	75	0.4 0.4 1.5	0	Filament
g voltage, V	0	104	1.4	-(0.5 to 0.65)	118	1.5	0	Filament
g voltage, V		Filament	270	220	0 to -(8-12)		0	13
g voltage, V		Filament	270	220	0 to -(8-12)		0	13
g voltage, V		285		~280		~280		285

Secret

50X1-HUM

1	2	3	4	5	6	7	8	9	10
			Ignition Voltage Rectifier ЯП-01						
	2Ц2С	Operating voltage, V (Anode cap -970 V)		~>1000					~>100
			Generator ГА-01						
12	6Н8С	Operating voltage, V	42	275	58	25	277	53	
13	6Н8С	Operating voltage, V	-0.1	245	12.5	-0.05	165	6.5	
14	6П3С	Operating voltage, V			150	140	0.1		
15	6П3С	Operating voltage, V			150	140	0.1		
16	6Ц4С	Operating voltage, V		185		-2.2		-2.1	
			Echo Signal Receiver ЕЭ-02 Employing Valves 6Ж3П						
1	6Ж3П	LGC-RGC switch in LGC position, while LGC knob in extreme left position		1.8-0.8			115-105		
2	6Н15П	LGC-RGC switch in LGC position while LGC knob in extreme left position		105-95					1.8-
3	6Ж3П	LGC-RGC switch in LGC position while LGC knob in extreme left position					110-95	120-105	1.8-
4	6Ж3П	LGC-RGC switch in LGC position while LGC knob in extreme left position					110-95	120-105	1.8-
5	6Ж3П	LGC-RGC switch in LGC position while LGC knob in extreme left position					115-105	120-105	4-
6	6Ж3П	LGC-RGC switch in LGC position while LGC knob in extreme left position					110-95	120-105	1.8-
7	6Ж3П	LGC-RGC switch in LGC position while LGC knob in extreme left position					110-95	120-105	1.8-
8	6Ж3П	LGC-RGC switch in LGC position while LGC knob in extreme left position					320-300	120-105	1.8-

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1	2	3	4	5	6	7			
10	6Ж4	Operating voltage, V						50-4	
11	6Ж4	Operating voltage, V					2-1	120-110	
13	6Ж4	Operating voltage, V					4-2	120-105	
14	TT1-0.1/ 1.8	Operating voltage, V						-250 to -230	
15	TT1-0.1/ 0.8	Operating voltage, V							
16	6X9C	Operating voltage, V					120-105		
17	6X6C	Operating voltage, V					-32 to -27		
18	6П3C	Operating voltage, V			300-200	300-200			
19	K-11	On reflector 270/60-220/55. In two extreme positions of MSC potentiometer							
20	CГ3C	Operating voltage, V		-270 to -250					
21	CГ4C	Operating voltage, V		-155 to -145					
22	6П3C	Operating voltage, V			320-300	320-300			
23	6Ж4	Operating voltage, V						120-105	

Echo Signal Receiver ЕЭ-02 Employing Valves 6Ж1П

1	2	3	4	5	6	7			
1	6Ж1П	LGC-RGC switch in LGC position, while LGC knob in extreme left position					95-110	105-120	3
2	6Ж1П	LGC-RGC switch in LGC position while LGC knob in extreme left position					90	90	0.8-1.8
3	6Ж1П	LGC-RGC switch in LGC position while LGC knob in extreme left position					95-110	105-120	0.8-1.8

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3	4	5	6	7	8	9	10	11
ating voltage, V						50-40		105-90
ating voltage, V					2-1	120-110		110-90
ating voltage, V					4-2	120-105		150-90
ating voltage, V						-250 to -230		-250 to -230
ting voltage, V								-250 to -230
ting voltage, V					120-105			
ting voltage, V					-32 to -27			
ting voltage, V			300--200	300--200				
lector 270/60- extreme posi- MSC potentio-								
ing voltage, V		-270 to -250						
ing voltage, V		-155 to -145						
ing voltage, V			320--300	320--300				120-105
ing voltage, V						120--105		115-95

Echo Signal Receiver E3-02 Employing Valves 6Ж1П

3	4	5	6	7	8	9	10	11
switch in LGC while LGC knob e left position					95-110	105-120	3	
switch in LGC while LGC knob e left position					90	90	0.8-1.8	
switch in LGC while LGC knob e left position					95-110	105-120	0.8-1.8	

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1	2	3	4	5	6	7	8	9	1
4	6Ж1П	LGC-RGC switch in LGC position while LGC knob in extreme left position					95-110	105-120	0.8-1
5	6Ж1П	LGC-RGC switch in LGC position while LGC knob in extreme left position					95-110	105-120	4-6
6	6Ж1П	LGC-RGC switch in LGC position while LGC knob in extreme left position					95-110	105-120	3
7	6Ж1П	LGC-RGC switch in LGC position while LGC knob in extreme left position					95-110	105-120	4
8	6Ж1П	LGC-RGC switch in LGC position while LGC knob in extreme left position					95-110	105-120	4
10	6Ж4	Operating voltage, V						40-50	
11	6Ж4	Operating boltage, V					2-1	120-110	
13	6Ж4	Operating voltage, V					4-2	120-105	
14	TT1-0.1/0.3	Operating voltage, V						-250 to -230	
15	TT1-0.1/0.3	Operating voltage, V							
16	6E9C	Operating voltage, V						120-105	
17	6E5C	Operating voltage, V					-32 to -27		
18	6П3C	Operating voltage, V			300 - -200	300- -200			
19	K-11	On reflector 270/60-220/55. In two extreme positions of MSC potentiometer							
20	CГ3C	Operating voltage, V		-270 to -250					
21	CГ4C	Operating voltage, V		-155 to -145					

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Stamped

2	3	4	5	6	7	8	9	10	11
1П	LGC-RGC switch in LGC position while LGC knob in extreme left position					95-110	105-120	0.8-1.8	
1П	LGC-RGC switch in LGC position while LGC knob in extreme left position					95-110	105-120	4-6	
1П	LGC-RGC switch in LGC position while LGC knob in extreme left position					95-110	105-120	3	
1П	LGC-RGC switch in LGC position while LGC knob in extreme left position					95-110	105-120	4	
1П	LGC-RGC switch in LGC position while LGC knob in extreme left position					95-110	105-120	4	
4	Operating voltage, V						40-50		90-105
4	Operating boltage, V					2-1	120-110		110-90
4	Operating voltage, V					4-2	120-105		150-90
1-0.1/ 0.8	Operating voltage, V						-250 to -230		-250 to -230
1-0.1/ 0.8	Operating voltage, V								-250 to -230
9C	Operating voltage, V						120-105		
6C	Operating voltage, V					-32 to -27			
3C	Operating voltage, V			300 - -200	300- -200				
11	On reflector 270/60-220/55. In two extreme positions of MSC potentiometer								
8C	Operating voltage, V		-270 to -250						
4C	Operating voltage, V		-155 to -145						

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3	4	5	6	7	8	9	10	11
ng voltage, V			320– -200	320– -300				120-105
ng voltage, V						120-105		115-95
Receiver Supply Unit БК-01								
ng voltage, V		320	340			340		320
ng voltage, V		320	340			340		320
ng voltage, V		Filament	1000			1000		Filament
Mixer СБ-50								
TION switch ON		Filament	0.75	0.45	0.65		Filament	0.45
TION switch OFF			0.7	0.42	0.65			0.42
TION SWITCH OFF								
NS., MIDDLE								
inimum			(-2.7)	1.0				
aximum			0.7	1.2				
NS., UPPER								
inimum					-2.6			1.0
aximum					-0.9			0.2
TION switch ON		Filament			0.6		Filament	0.45
TION switch OFF					0.6			0.45
TION switch OFF								
CHANNEL COMPENS.,								
crew:								
inimum					(-2.7)			0.42
aximum					0.6			0.35
hes: TION ON, OFF, ER ON	-150	0.65	-130	-150	1.0	0.3	Filament	Filament
hes: TION OFF, OFF, ER ON	-150	0.65	-130	-150	1.0	0.3		

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3	4	5	6	7	8	9	10	11
Switches: RECEPTION ON, BLANK ON, TRIGGER ON	-150	0.65	-130	-150	1.0	-130		
Switches: RECEPTION ON, BLANK ON, TRIGGER OFF	-150	0.65	-130	-150	1.1	-130		
RECEPTION switch ON OFF		Filament	175 175	0.15 0.15	3.0 3.0	175 175	Filament	175 175
Switches: RECEPTION ON, SELECTOR OUTPUT ON		Filament	12.5	8.5	12.5	110	Filament	260
Switches: RECEPTION OFF, SELECTOR OUTPUT ON			-0.7	-20	-0.7	150		275
Switches: RECEPTION OFF, SELECTOR OUTPUT ON			9	6.5	9	120		260
Switches: RECEPTION OFF, SELECTOR OUTPUT OFF			-0.7	-20	-0.7	150		275
Switches: RECEPTION ON, SELECTOR-OFF OUTPUT, SELECTOR OUTPUT } OFF		Filament	0	-21.5	0.65	290	Filament	290
Switches: RECEPTION ON, SELECTOR-OFF OUTPUT, SELECTOR OUTPUT } ON			0	-21.5	2.25	290		290
Switches: RECEPTION OFF, SELECTOR-OFF OUTPUT, SELECTOR OUTPUT } OFF			0	-21.5	0.65	290		290

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2	3	4	5
[illegible]	Switches: RECEPTION OFF SELECTOR-OFF OUTPUT } ON SELECTOR OUTPUT ...ERT. OUTPUT CUT-OFF ...ting screw: ...nimum ...imum		
[illegible]	...:	27 27 27 -14 -27.5	300 290 300
[illegible]	[illegible]	-150 -210 -150	0 1.4 0
[illegible]	... switch ON / OFF		Filan...
[illegible]	...s: ...TION ON ...ECTOR-OFF OUTPUT ON		Filan...

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3	4	5	6	7	8	9	10	11
witches: ECEPTION OFF ELECTOR-OFF OUTPUT ELECTOR OUTPUT } ON			0	-21.5	0.65	290		290
ERT.OUTPUT CUT-OFF usting screw: Minimum Maximum				 -10 -33				
witches: LANK OFF RIGGER ON	27	300	50	50	160	50	Filament	Filament
witches: LANK ON RIGGER ON	27	290	48	45	175	48		
itches: LANK ON RIGGER OFF	27	300	50	50	160	50		
ANK LENGTH screw: Minimum Maximum	 -14 -27.5							
itches: ANK OFF IGGER ON	-150	0	-130	-28	300	10	Filament	Filament
itches: NK OFF GGER ON	-210	1.4	-125	-28	295	0		
tches: NK ON GGER OFF	-150	0	-130	-28	295	0		
EPTION switch ON EPTION switch OFF		Filament	170 170	0.2 0.1	3 2.85	170 170	Filament	170 170
tches: EPTION ON ECTOR-OFF OUTPUT ON		Filament	0	-0.6	0	100	Filament	280

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1	2	3	4	5	6	[illegible]	8	9
16	6Ж4	Switches: RECEPTION ON SELECTOR-OFF OUTPUT OFF			0	-20	0	155
		Switches: RECEPTION OFF SELECTOR-OFF OUTPUT ON			0	-0.5	0	100
		Switches: RECEPTION OFF SELECTOR-OFF OUTPUT OFF			0	-20	0	155
[illegible]	6Ж4	Switches: RECEPTION ON SELECTOR OUTPUT ON		Filament	8	6	8	130
		Switches: RECEPTION ON SELECTOR OUTPUT OFF			-0.65	-22	-0.65	155
		Switches: RECEPTION OFF SELECTOR OUTPUT ON			8	5.5	8	130
		Switches: RECEPTION OFF SELECTOR OUTPUT OFF			-0.65	-22	-0.65	155
18	6П9	Switches: RECEPTION ON SELECTOR OUTPUT ON SELECTOR-OFF OUTPUT ON	0	Filament		-23	0	300
		Switches: RECEPTION ON SELECTOR OUTPUT OFF SELECTOR-OFF OUTPUT OFF	0			-23	0.2	300
		Switches: RECEPTION OFF SELECTOR OUTPUT ON SELECTOR-OFF OUTPUT ON	0			-23	0.2	300

3	4	5	6	7	8	9	10	11
Switches: RECEPTION ON SELECTOR-OFF OUTPUT OFF			0	-20	0	155		300
Switches: RECEPTION OFF SELECTOR-OFF OUTPUT ON			0	-0.5	0	100		280
Switches: RECEPTION OFF SELECTOR-OFF OUTPUT OFF			0	-20	0	155		300
Switches: RECEPTION ON SELECTOR OUTPUT ON		Filament	8	6	8	130	Filament	270
Switches: RECEPTION ON SELECTOR OUTPUT OFF			-0.65	-22	-0.65	155		280
Switches: RECEPTION OFF SELECTOR OUTPUT ON			8	5.5	8	130		270
Switches: RECEPTION OFF SELECTOR OUTPUT OFF			-0.65	-22	-0.65	155		280
Switches: RECEPTION ON SELECTOR OUTPUT ON SELECTOR-OFF OUTPUT ON	0	Filament		-23	0	300	Filament	300
Switches: RECEPTION ON SELECTOR OUTPUT OFF SELECTOR-OFF OUTPUT OFF	0			-23	0.2	300		300
Switches: RECEPTION OFF SELECTOR OUTPUT ON SELECTOR-OFF OUTPUT ON	0			-23	0.2	300		300

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	4	5	6	7	8	9	10	11
FF TPUT OFF }	0			-23	0.2	300		300
T CUT-OFF ew:				-37 -10				
itch {ON OFF		Filament	0 0	-0.6 -0.45	0 0	90 90	Filament	280 280
itch {ON OFF		Filament	300 300	0 0	22.5 22.5	300 300	Filament	300 300
UT CUT-OFF					8 33			
itch {ON OFF		Filament	0 0	0.05 0.05	2 2	130 130	Filament	290 290
itch {ON OFF		Filament	0 0	0 0	4.5 4.5	230 230	Filament	230 230
itch {ON OFF		Filament	38 35	33 33	38 35	0 0	Filament	300 300
tch {ON OFF		Filament	0 0	-0.75 -0.65	0 0	100 90	Filament	285 285
tch {ON OFF		Filament	300 300	0.05 0.05	31 31	300 300	Filament	300 300
T CUT-OFF					7.5 3.7			
tch {ON OFF		Filament	0 0	0.05 0.05	2 2	125 125	Filament	290 290
ch {ON OFF		Filament	0 0	0 0	4.5 4.5	230 230	Filament	235 235
ch {ON OFF		Filament	35 35	35 35	35 35	0 0	Filament	
ch OFF R. cont-								

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1	2	3	4	5	6	7	8	9	10
23	6Х6	Slant channel: Maximum			2.6	0.35			
		Minimum			0.6	0.02			
		COMPENS., LOWER control:							
		Maximum					-1.9		
		Minimum					0.45		
25	2Ц2С	Operating voltage, V		930				930	
26	2Ц2С	Operating voltage, V		-23				-23	
27	ТГ1-0.1/1.8	TRIGGER switch ON		Filament	65		-9	0	Filamen[t]
		TRIGGER switch OFF			645		-10.5	0	
28	6Ж4	Operating voltage, V		Filament	190	-3.1	0	190	Filamen[t]

Type	Position of controls during measurements	Number of tube pins: 1	2	3	4	5	6	7	8	9	10
8Л029 cathode-ray tube	Switches: RECEPTION ON, BLANK OFF	Filament	-880	-850		-650		30	30	35	6[illegible]
	Switches: RECEPTION ON, BLANK OFF		-870	-850		-650		30	30	35	6[illegible]
	Switches: RECEPTION OFF, BLANK ON		-870	-850		-650		30	30	35	63
	Switches: RECEPTION OFF, BLANK ON		-880	-830		-655		30	30	35	63

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	3	4	5	6	7	8	[illegible]	10	11
Slant channel	Maximum			2.6	0.35				
	Minimum			0.6	0.02				0.02
	COMPENS., LOWER control:								0.35
	Maximum								
	Minimum					-1.9			
						0.45			
	Operating voltage, V		930						
	Operating voltage, V		-23				930		Anode-22
1/ 3	TRIGGER switch ON / OFF		Filament	65 / 645		-9 / -10.5	-23 / 0 / 0	Filament	Anode-940 / 0 / 0
	Operating voltage, V		Filament	190	-3.1	0	190	Filament	190

...sition of controls ...ring measurements	Number of tube pins										
	1	2	3	4	5	6	7	8	9	10	11
Switches: ...CEPTION ON ...ANK OFF	Filament	-880	-850		-650		30	30	35	63	45
Switches: ...CEPTION ON ...ANK OFF		-870	-850		-650		30	30	35	63	45
Switches: ...CEPTION OFF ...ANK ON		-870	-850		-650		30	30	35	63	44
Switches: ...EPTION OFF ...NK ON		-880	-830		-655		30	30	35	63	44

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APPENDIX 1B

RESISTANCE TABLE OF STATION UNITS

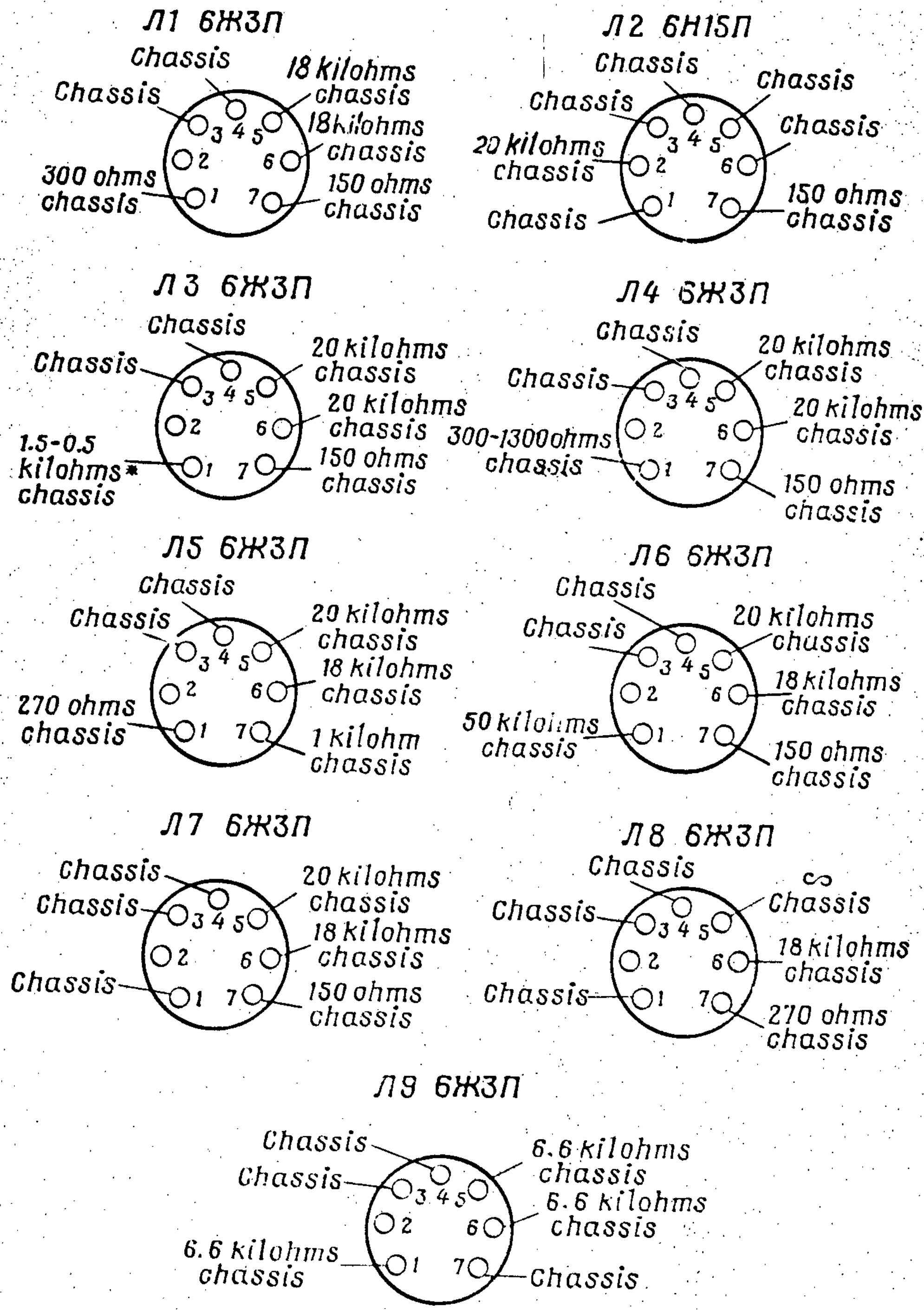
The table gives the rated resistance values for all units the circuit.

The resistance is checked with the tester, type TT-1, aced into circuit between the valve pins (lugs of the valve se) or the jacks of the connectors and the respective buses the supply voltage or the housing of the unit as well as to monitoring jacks.

The resistance values marked with an asterisk (^{x}) corres- nd to the positions of the switches given below the tables.

The resistance values marked with two asterisks (^{xx}) cor- spond to the certain positions of slides on the potentiome- s, whose diagrams numbers are given below the tables.

Unit Eэ-02 Employing Valves 6Ж3П



* With RGC switch at INFINITY

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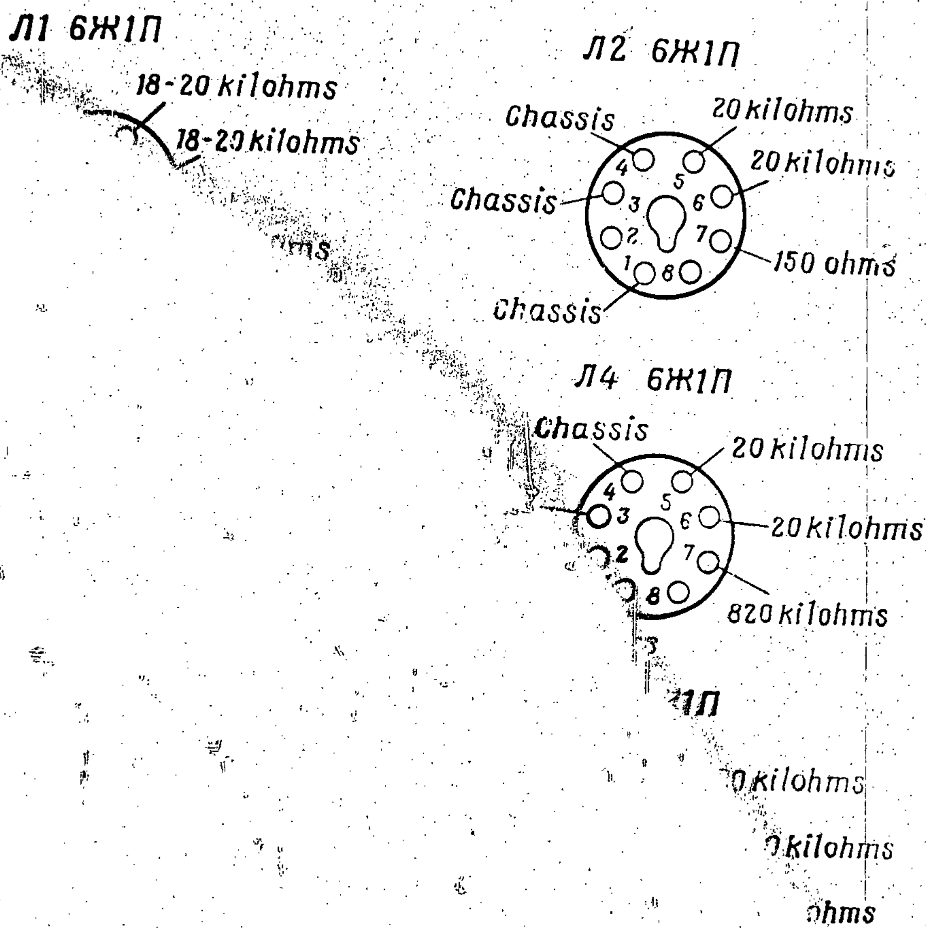
Unit ЕЭ-02 Employing Valves 6Ж1П



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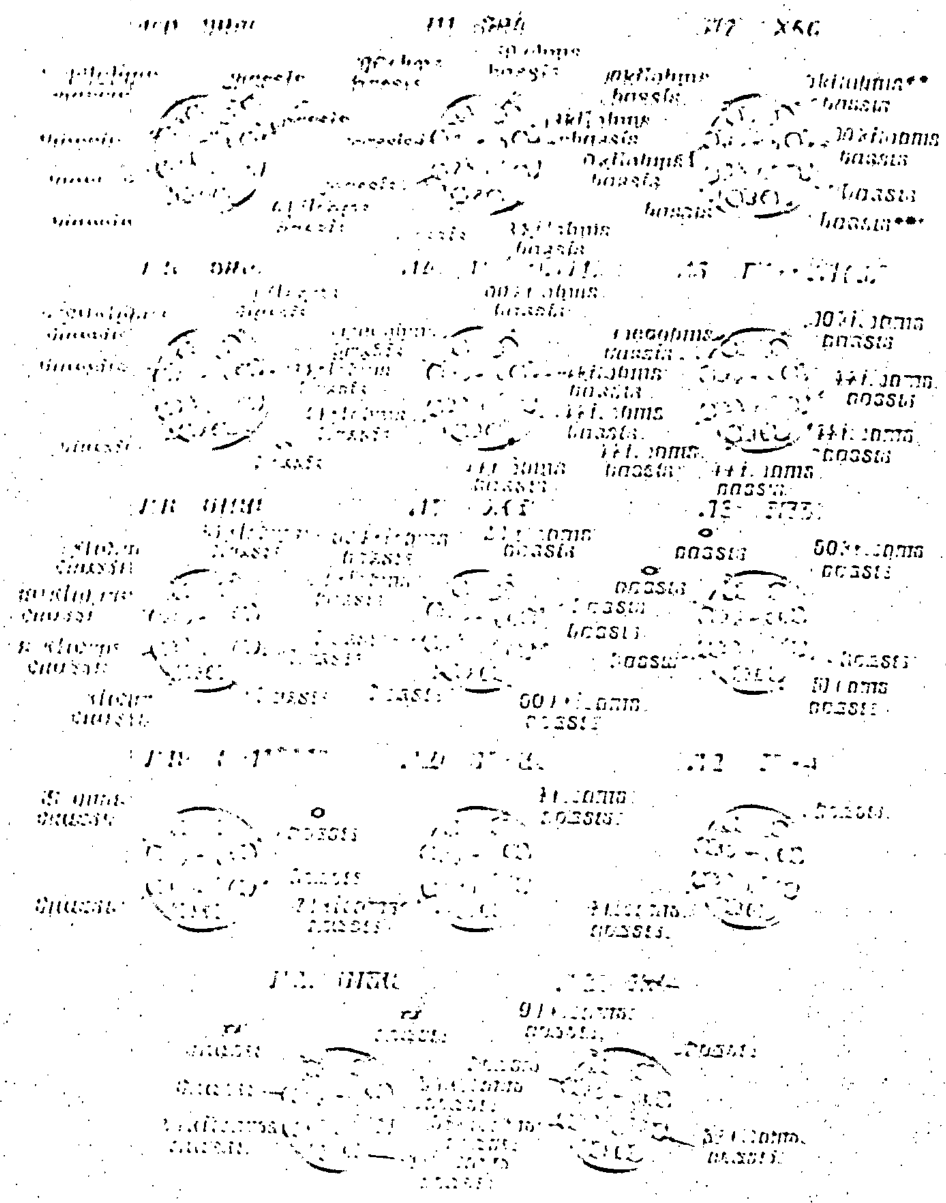

[illegible]

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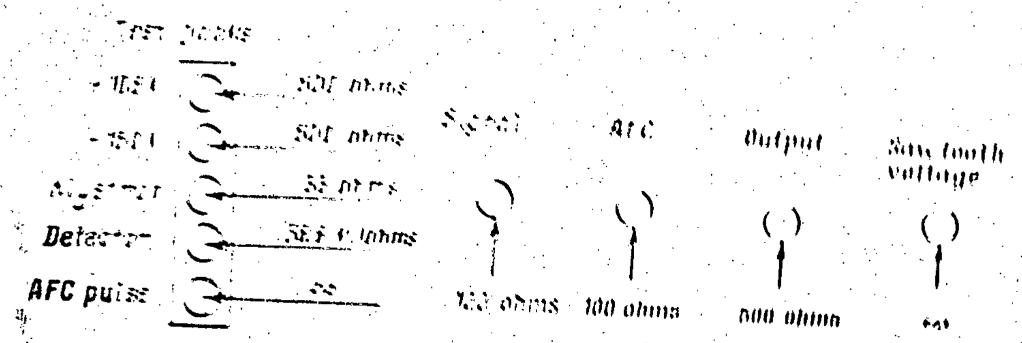
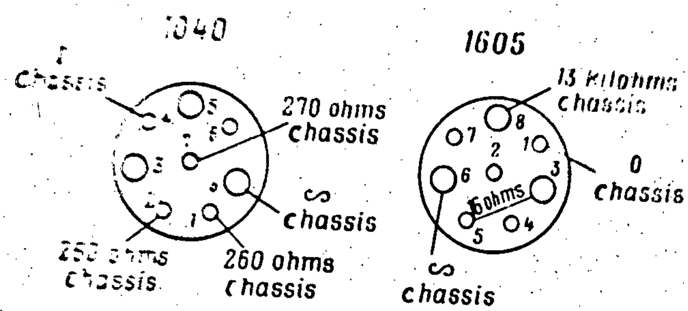
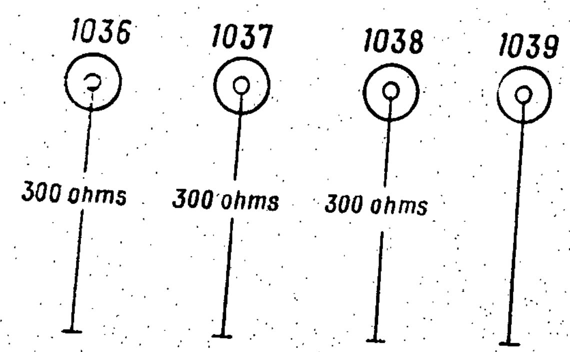


Connectors

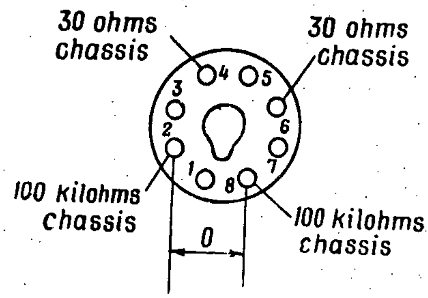




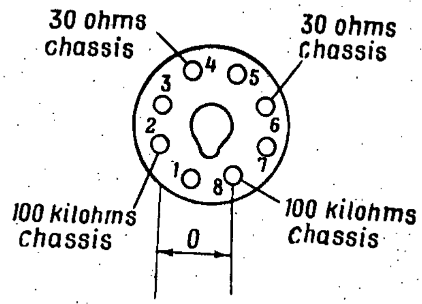
Switch in LGC position

Unit БК-01

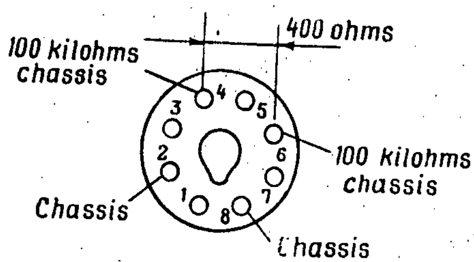
Л1 5Ц4С



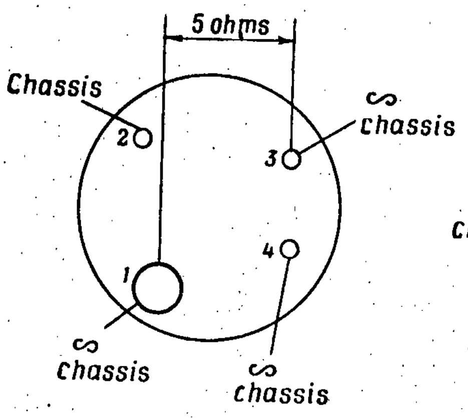
Л2 5Ц4С



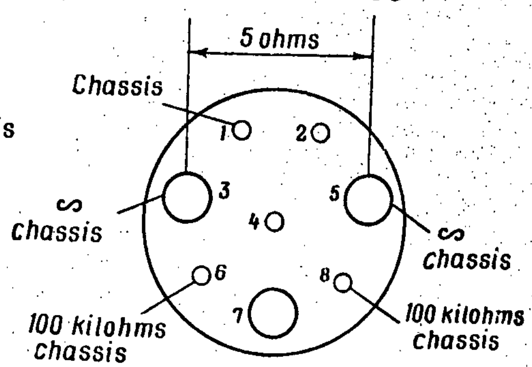
Л3 5Ц4С



Connector 1604

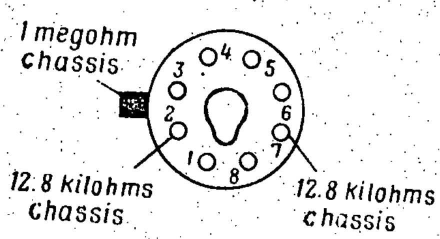


Connector 1605



Unit ЯП-01

Л1 2Ц2С



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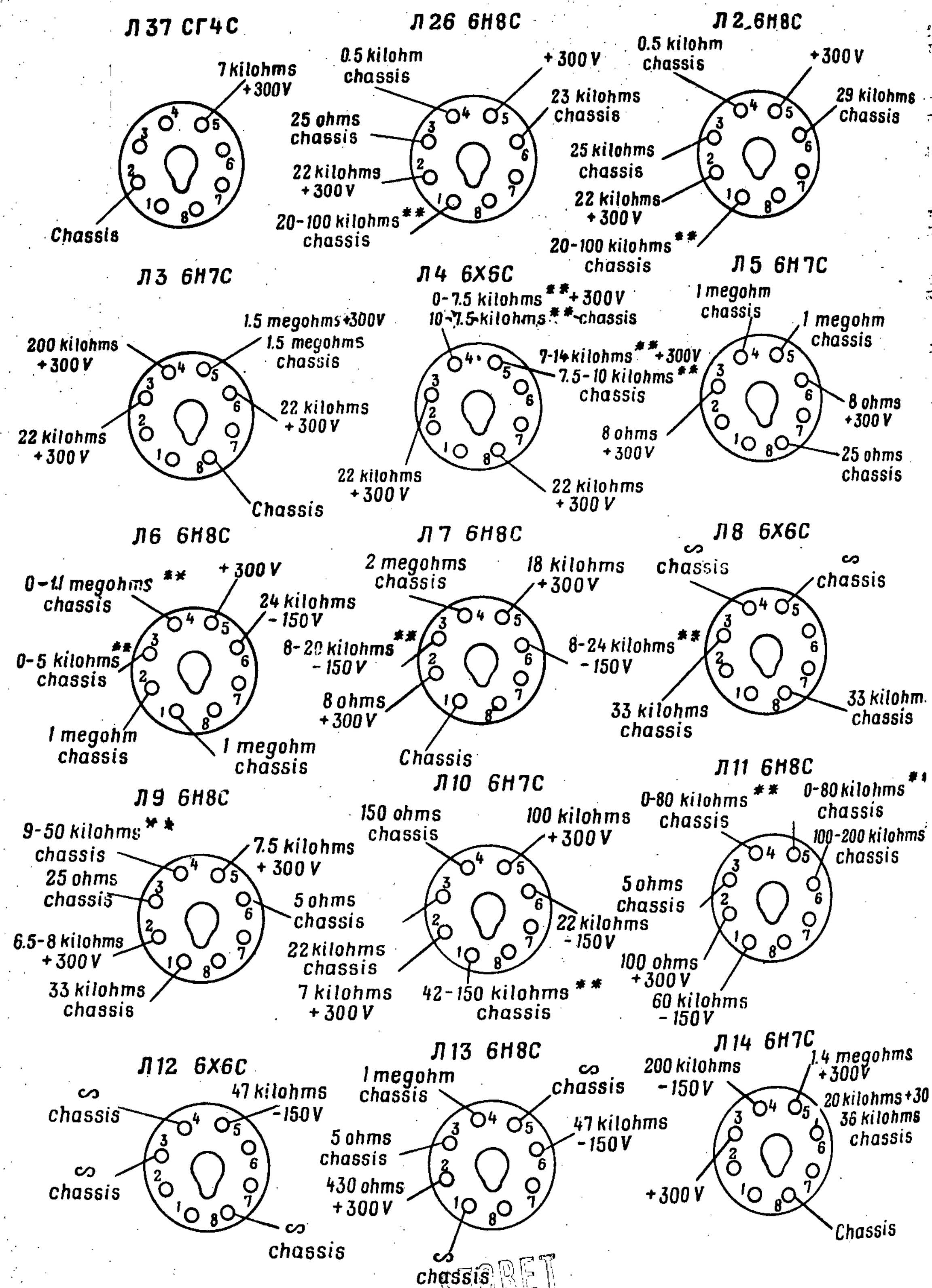
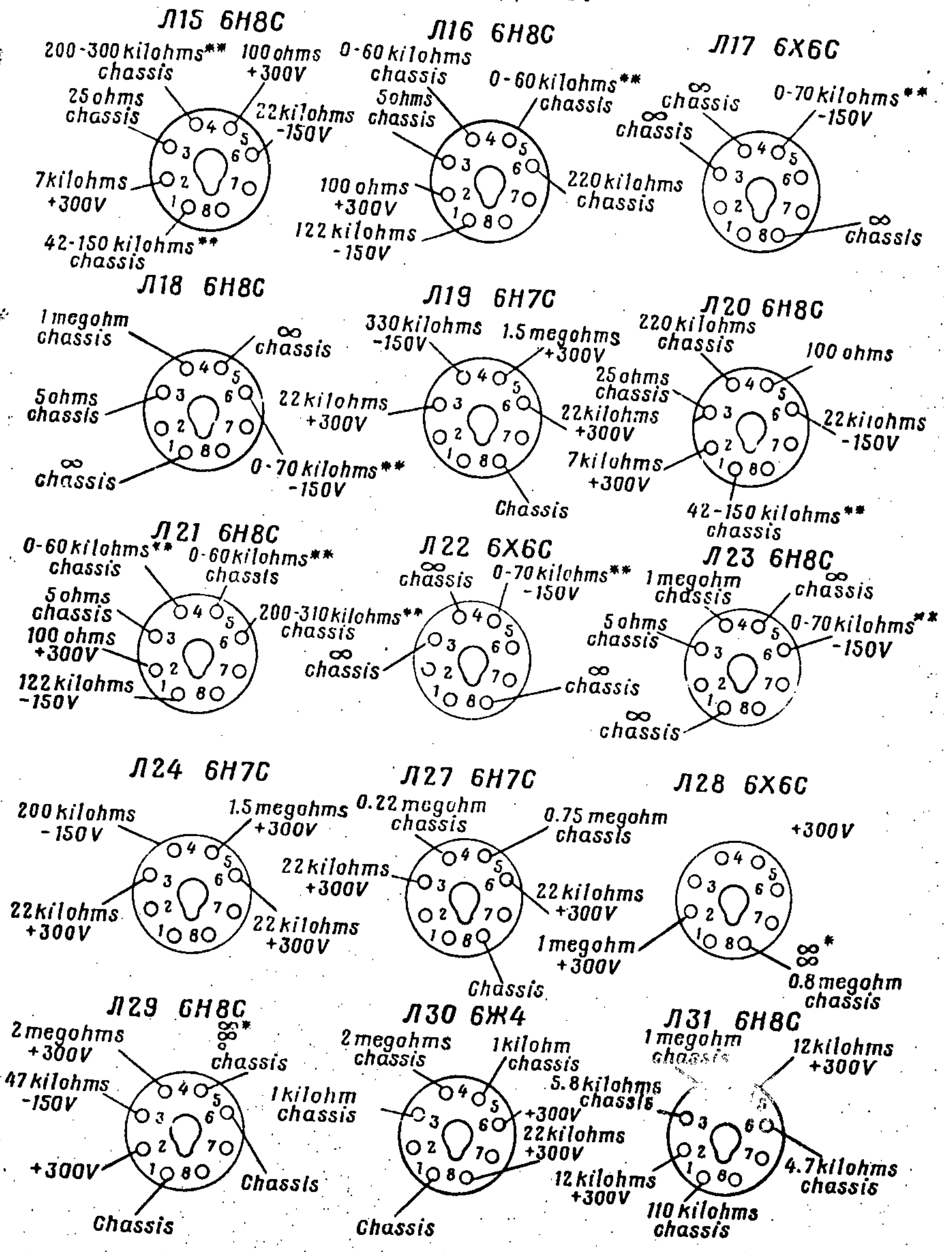
Unit ДА-01



** See Table of variable resistors for unit ДА-01

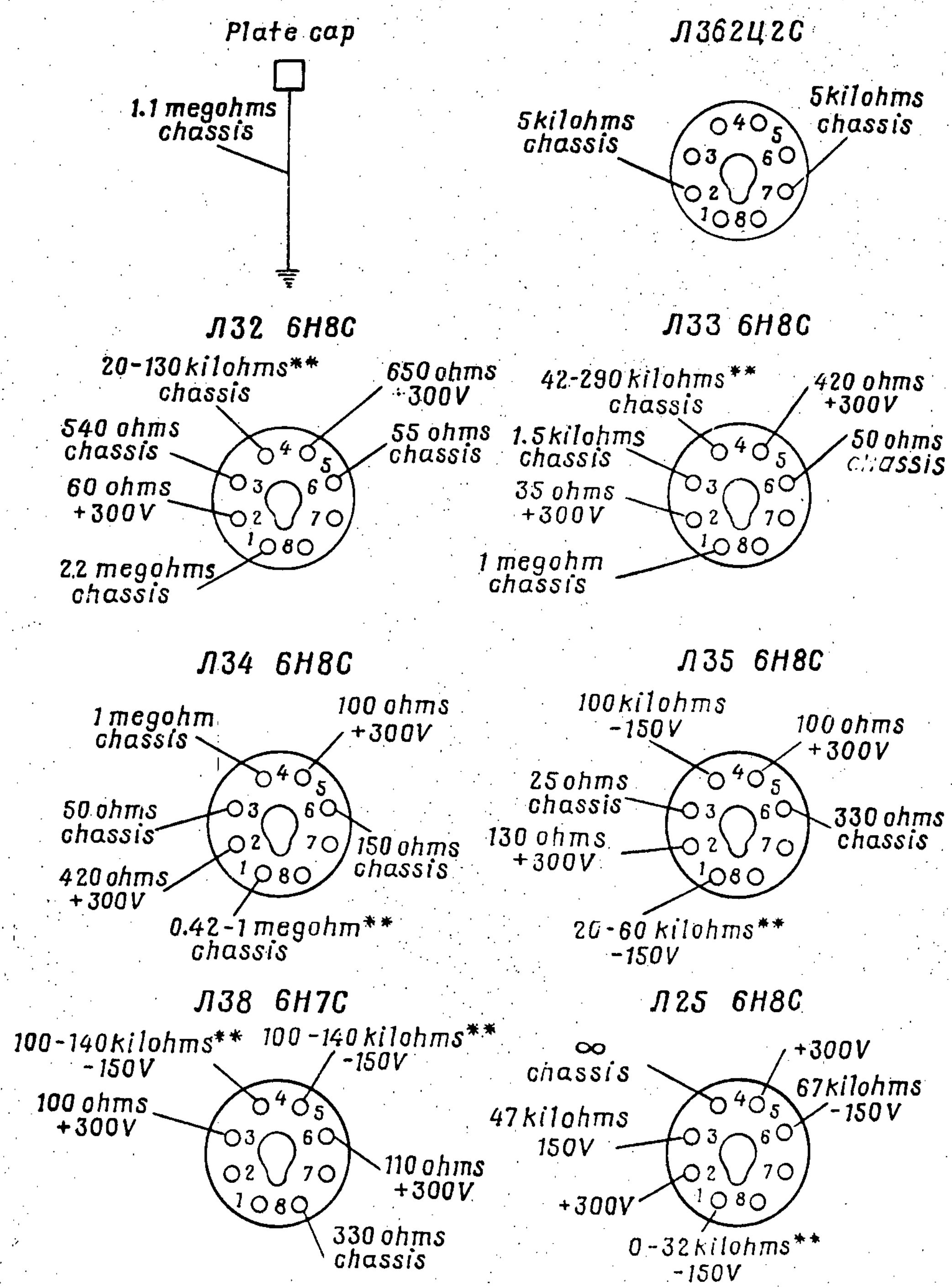
Unit ДА-01 continued



* In positions 1,2 and 3 of switch 772
** See Table of variable resistors for unit ДА-01

Continued

Unit ДА-01



** See Table of variable resistors for unit ДА-01

 281

Continued

ДА-01

1094

assis

s

-15	Л-17
H8C	6X6C
172	173

	5	Л-26	Л-32
	C	6H8C	6H8C
	150	211	246

323					

Resistance across Jacks of Range Marker Unit ДА-01

Serial number of jack	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Jack numbers in key diagram	777	778	779	780	781	782	783	784	785	786	787	788		
Resistance	22 ohms	100 ohms	100 ohms	100 ohms	55 ohms	5 ohms	22 ohms	22 ohms	820 ohms	∞	1000 ohms	1000 ohms		

Serial number of jack	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Jack numbers in key diagram	765	766	767	768	769	770		771	772	773	774	775	776	
Resistance	22 ohms	100 ohms	5 ohms	5 ohms	5 ohms	100 ohms		22 ohms	100 ohms	5		5 ohms	100 ohms	

Serial number of jack	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Jack numbers in key diagram	751	752	753	754	755	756	757	758	759	760	761	762	763	764
Resistance	22 ohms	100 ohms	100 ohms	22 ohms	120 ohms	55 ohms	150 ohms	22 ohms	5 ohms	22 ohms	100 ohms	5 ohms	5 ohms	22 ohms

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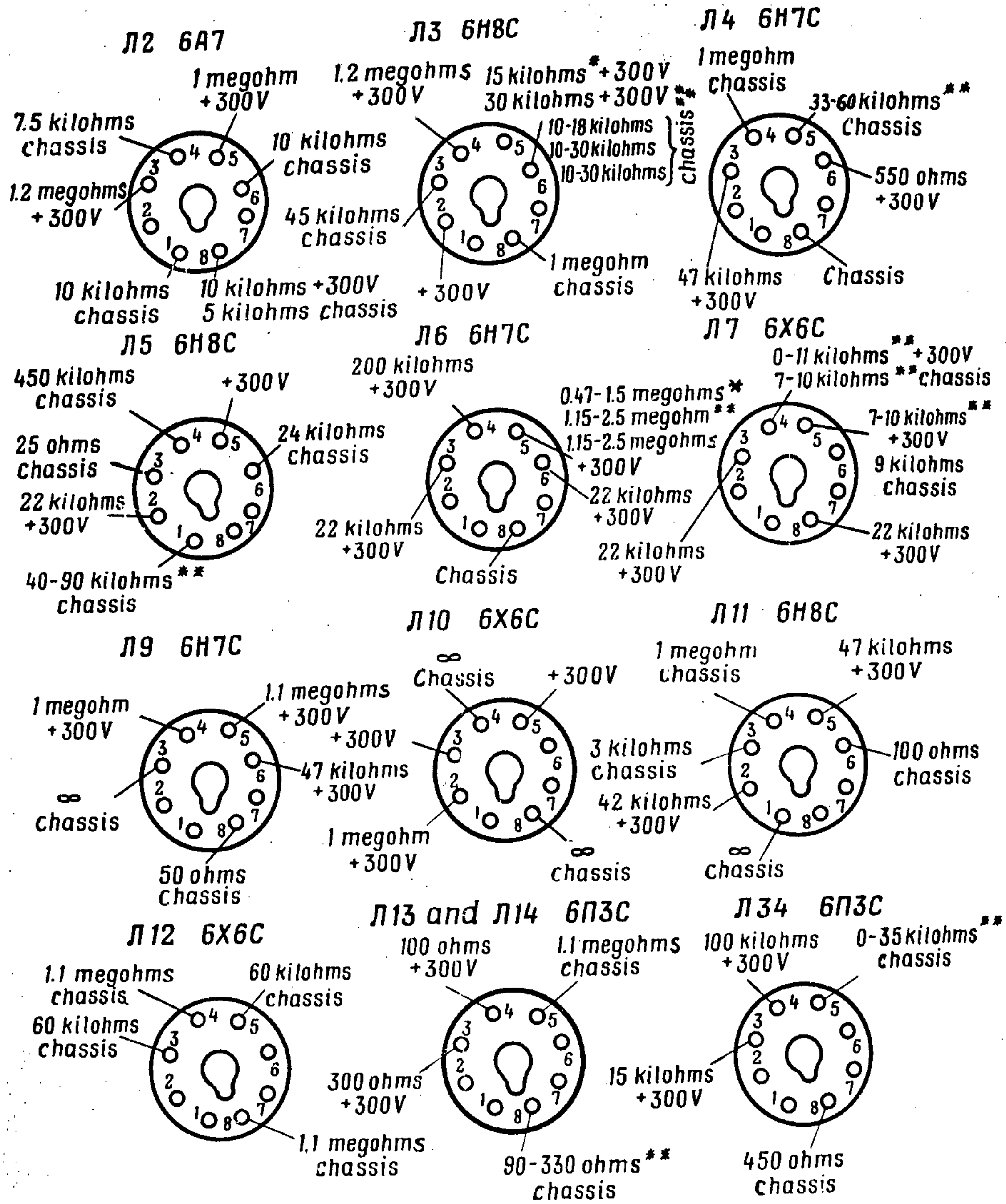
Unit ПО-02

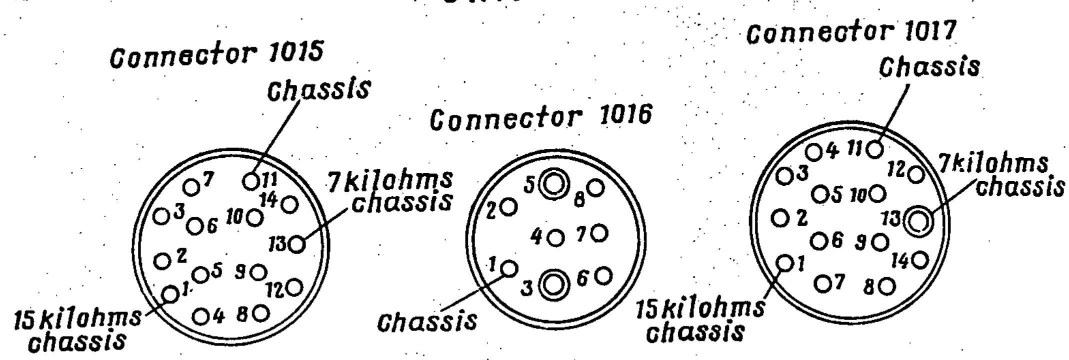


* With SWEEP DURATION switch in positions 80, 200, 400, respectively (from top to bottom)

** See Table of variable resistors for unit ПО-02

Continued

Unit ПО-02



Variable Resistors in Valve Circuits
of Unit

Valve numbers in key diagram...... Types	Л-3 6Н8С	Л-4 6Н7С	Л-5 6Н8С	Л-6 6Н7С	Л-7 6Х6С	Л-13 6П3С
Numbers of variable resistors in key diagram	119 113 124 125	136	143	153, 154	157(left) 158(right)	197

Valve numbers in key diagram...... Types	Л-15 6Н8С	Л-16 6Х6С	Л-18 6Н8С	Л-19 6Ж4	Л-20 6Ж4	Л-21 6Ж4	Л-34 6П3С
Numbers of variable resistors in key diagram	207 (left) 208 (right)	216 (right) 217 (left)	280	243	255	465	475

Serial number of Resistance across Jacks of Unit

14 13 12 11 10 9 8 7 6 5 4 3 2 1

		12	13	14
1-ohm	812 1 kil-ohm	-	-	-

				10	11	12	13	14
[illegible]5 ohms	100 ohms	760 5 ohms	793 1 kil-ohm	794 1 kil-ohm	795 ∞	796 ∞	797 ∞	809 ∞

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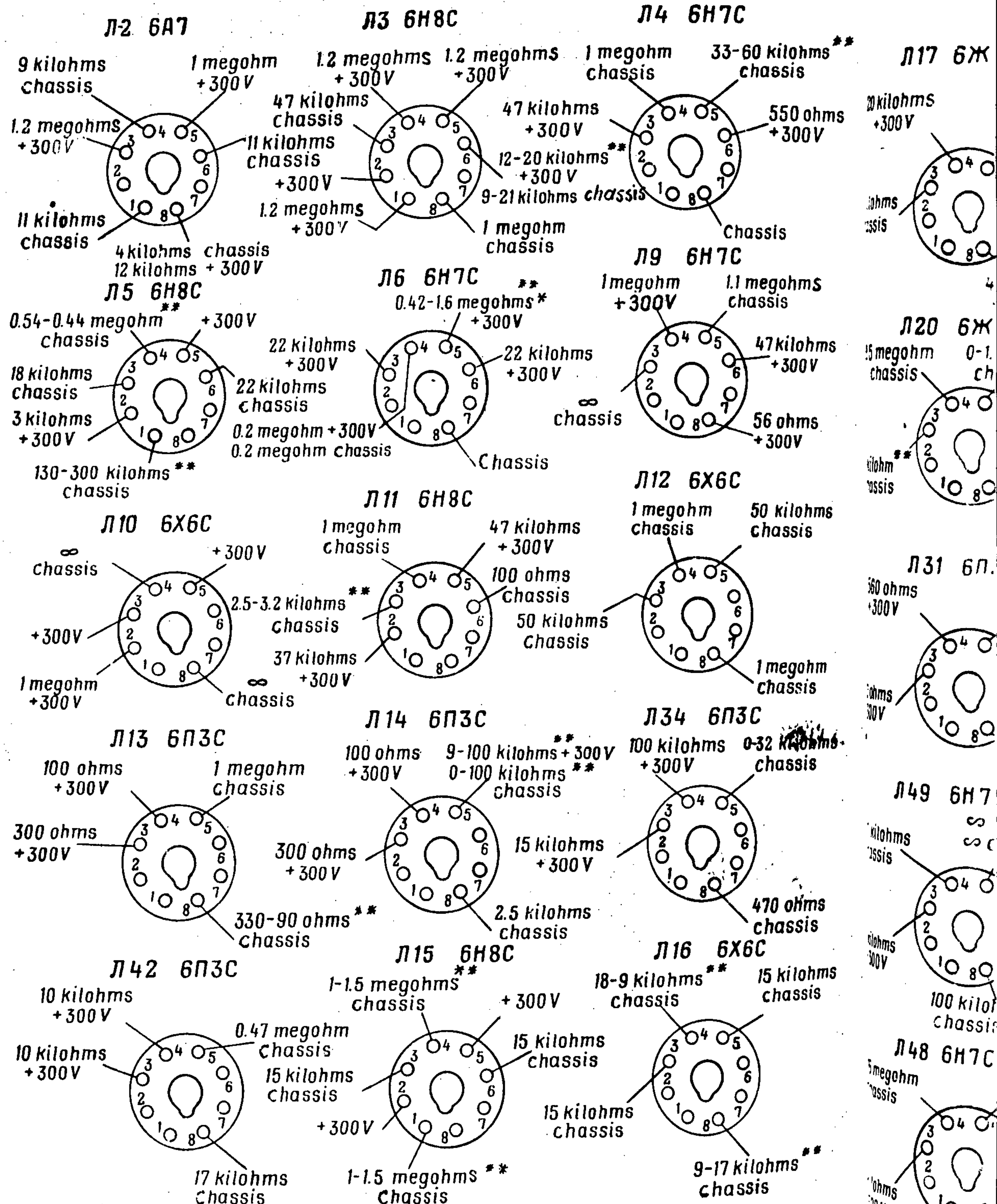
SECRET [redacted] 50X1-HUM

Unit B0-01

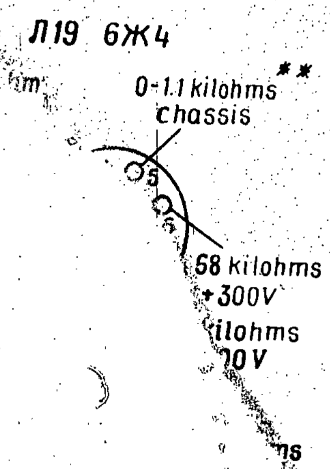


* See Table of variable resistors for unit B0-01

See Table of v

1

Continued



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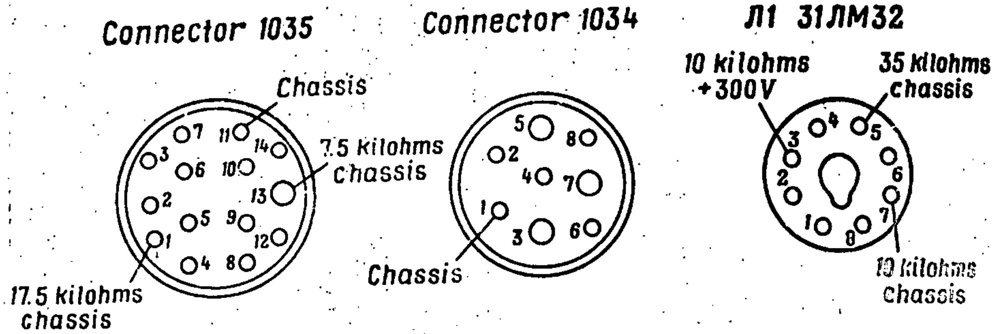
Unit BO-01



Variable Resistors in Valve Circuits of Unit

Valve numbers in key diagram	Л-3	Л-4	Л-5	Л-6	Л-11	Л-1[illegible]	[illegible]
Types......	6Н8С	6Н7С	6Н8С	6Н7С	6Н8С	6П3С	[illegible]
Numbers of variable resistors in key diagram	123 124 125	136	477	153 154	197	197	20[illegible]

Valve numbers in key diagram	Л-16	Л-18	Л-19	Л-20	Л-21	Л-27	Л-31	Л-34
Types	6Х6С	6Н8С	6Ж4	6Ж4	6Ж4	6Н8С	6П3С	6П3С
Numbers of variable resistors in key diagrams	216 227	280	243	255	465	305	355	475

		2	3	4	5		
		772	773	774	775	776	
[illegible] ohms	56 ohms	220 ohms	100 ohms	10 ohms	10 ohms	10 ohms	

Seri[illegible] of jac[illegible]						6	7	8	1	2	3	4	5	6	7
Jack numbers (left) in key diagram	752	[illegible]	[illegible]	[illegible]	756	758	759	760	793	794	795	796	797	798	809
Resistance	100 ohms	100 ohms	22 ohms	100 ohms	100 ohms	56 ohms	100 ohms	5 ohms	1 kil-ohm	1 kil-ohm	∞	∞	∞	∞	∞

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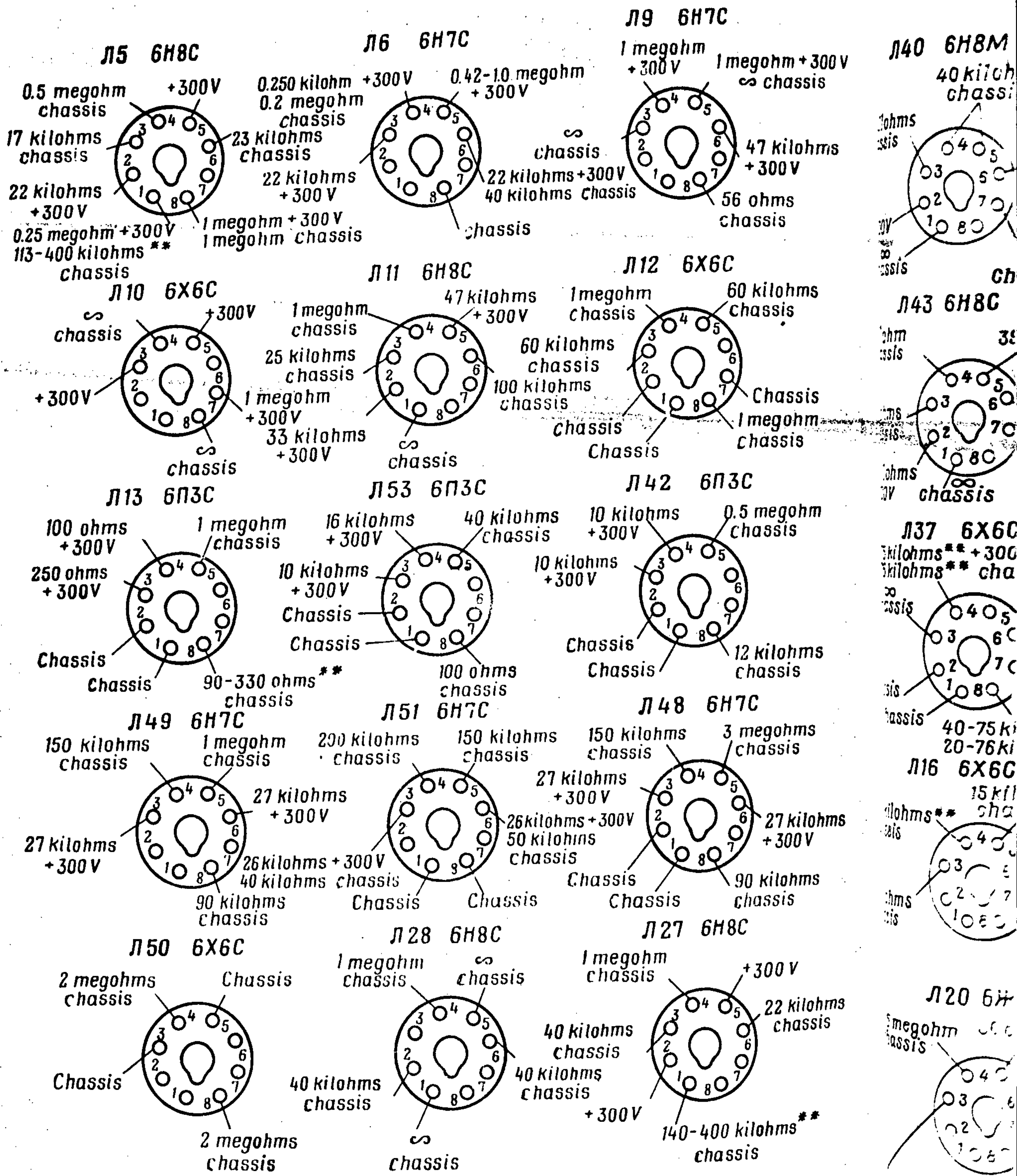
50X1-HUM

Unit HO-02



** See Table of variable resistors for unit HO-02

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50X1-HUM

Continued

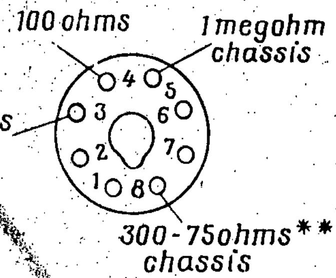
nit HO-02

5X6C

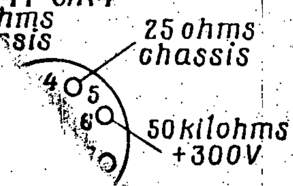
lohms
is

hms
V

Л45 6П3С



Л41 6Ж4
hms
ssis



∞
ssis

0V

lohms
assis

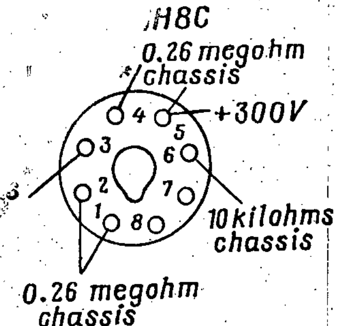
is

0V

30 kilohms
chassis

**

H8C



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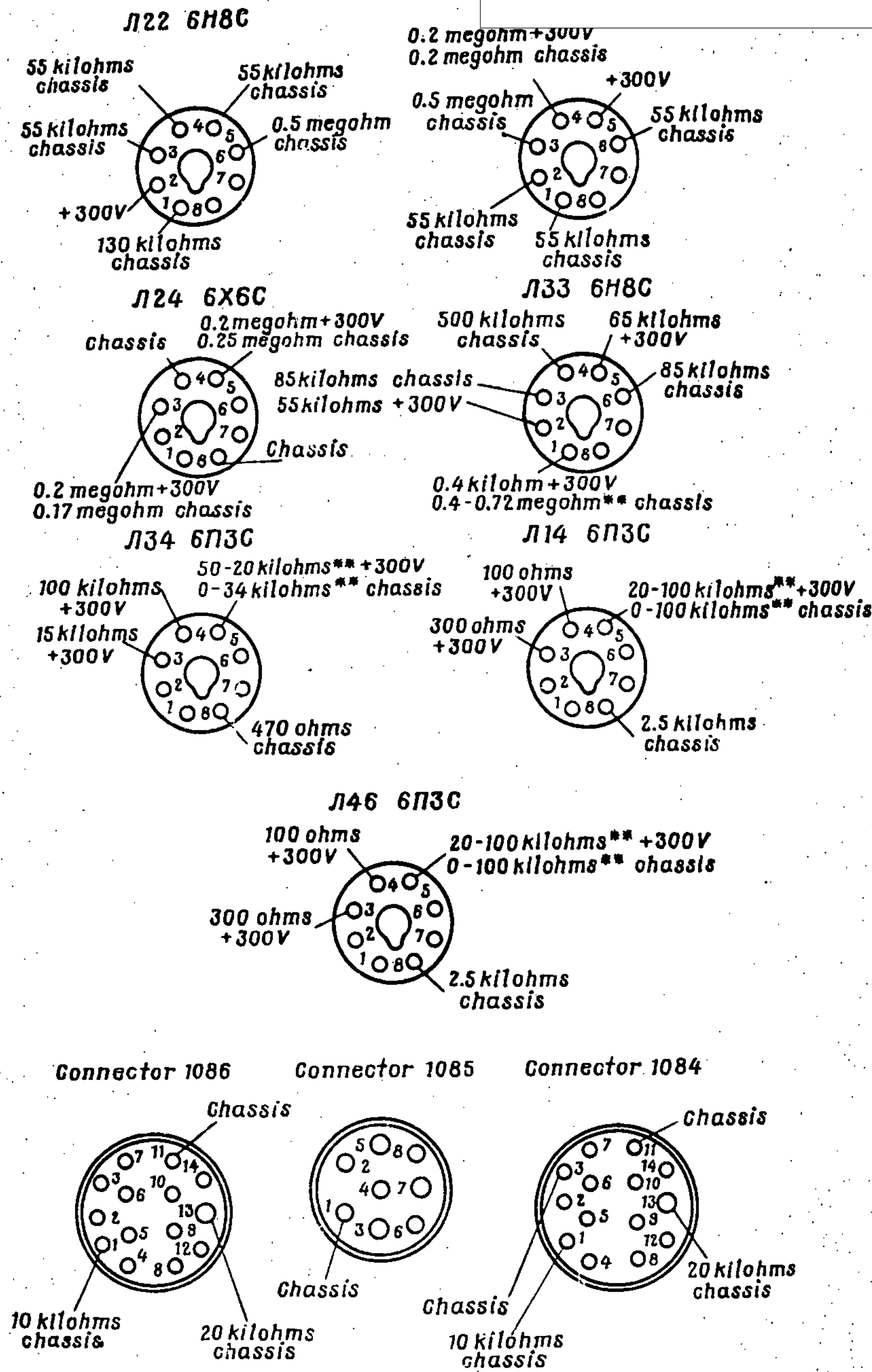
Unit HO-02

50X1-HUM



** See Table of variable resistors for unit HO-02

Valve nu
diag
Type
Number
resistor
diagram

Valve num
diagr
Type
Numbers
resistors
diagram

Serial number
of jack
Jack numbers
(right) in key
diagram
resistance
ohms

Serial number
of jack
jack numbers
(left) in key
diagram
resistance

Serial number
of jack
jack numbers
in key diagram 79
resistance 150
ohms

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Variable Resistors in Valve Circuits of Unit HO-02

Valve numbers in key diagram	Л-5	Л-6	Л-13	Л-14	Л-15	Л-15	Л-18	Л-20
Types	6Н8С	6Н7С	6П3С	6П3С	6Н8С	6Н8С	6Н8С	6Ж4
Numbers of variable resistors in key diagram	143	153	197	201	207 208	216 217	280	243
Valve numbers in key diagram	Л-21	Л-27	Л-33	Л-34	Л-37	Л-45	Л-46	
Types	6Ж4	6Н8С	6Н8С	6П3С	6Х6С	6П3С	6П3С	
Numbers of variable resistors in key diagram	255	305	370	475	385	419	420	

Resistance across Jacks of Unit HO-02

..mber	1	2	3				7	8	9	10	1	2	3	4	5	6
..ers ..n key	772	773	774				804	806	807	808	793	794	795	796	798	809
..nce	22 ohms	100 ohms	150 ohms				56 ohms	22 ohms	100 ohms	5 ohms	1 kil-ohm	1 kil-ohm	∞	∞	∞	∞
..al number of jack			3	4	5	6	7	8								
..k numbers ..ft) in key diagram			754	755	756	758	759	760								
Resistance			22 ohms	100 ohms	100 ohms	56 ohms	100 ohms	5 ohms								
Serial number of jack	1	2	3	4	5	6	7	8	9	10						
Jack numbers in key diagram	761	762	763	766	767	768	769	770	771	777						
Resistance	150 ohms	150 ohms	56 ohms	56 ohms	56 ohms	56 ohms	56 ohms	56 ohms	56 ohms	100 ohms						

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97

50X1-HUM

6Ж4

100 ohms
chassis

33 kilohms +300V
0 kilohms chassis

assis

ohms

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	Л-6
.6C	6Н8С
6	65

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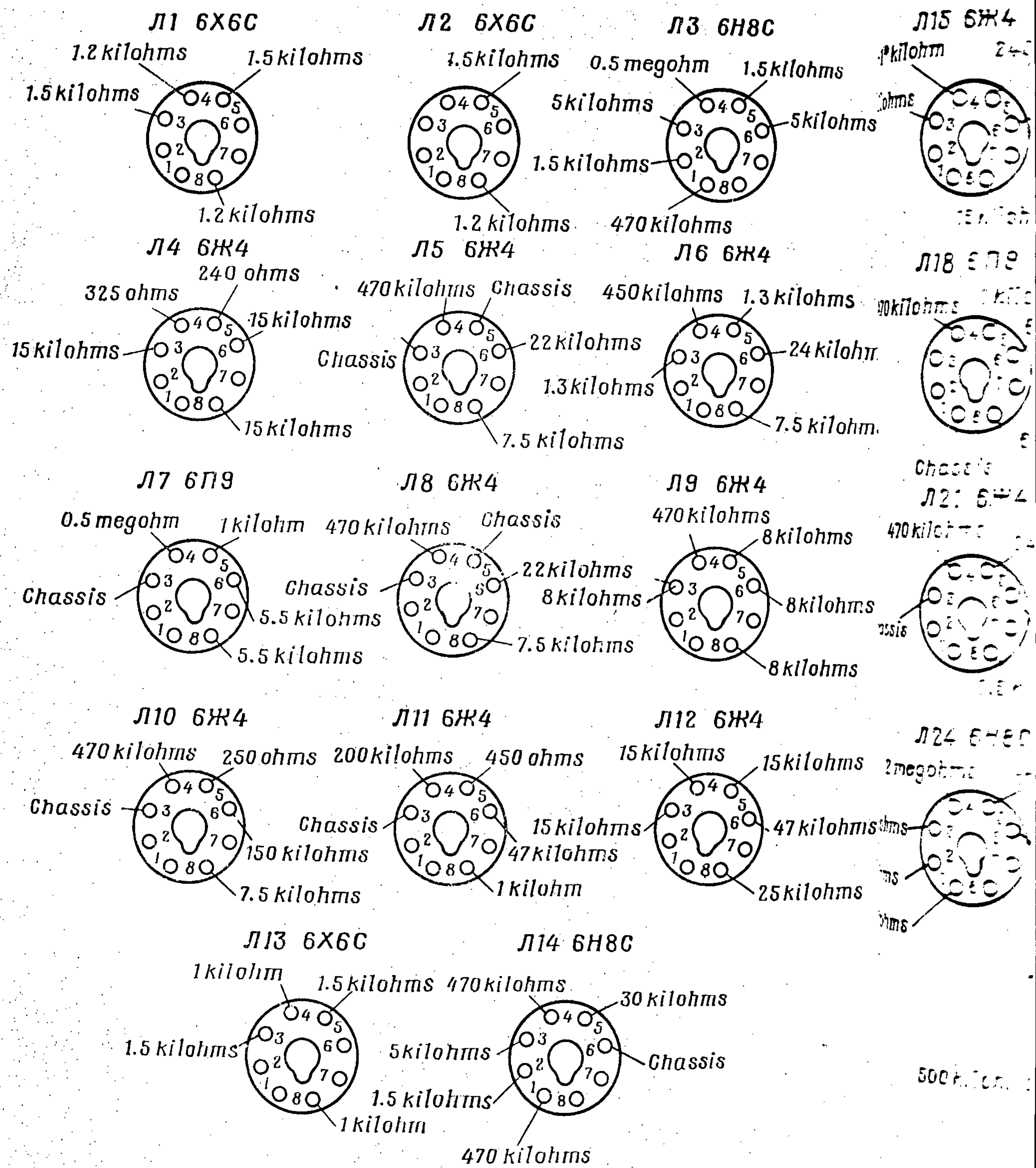
50X1-HUM

Unit СБ-50



* with master switch at BLANK, MID

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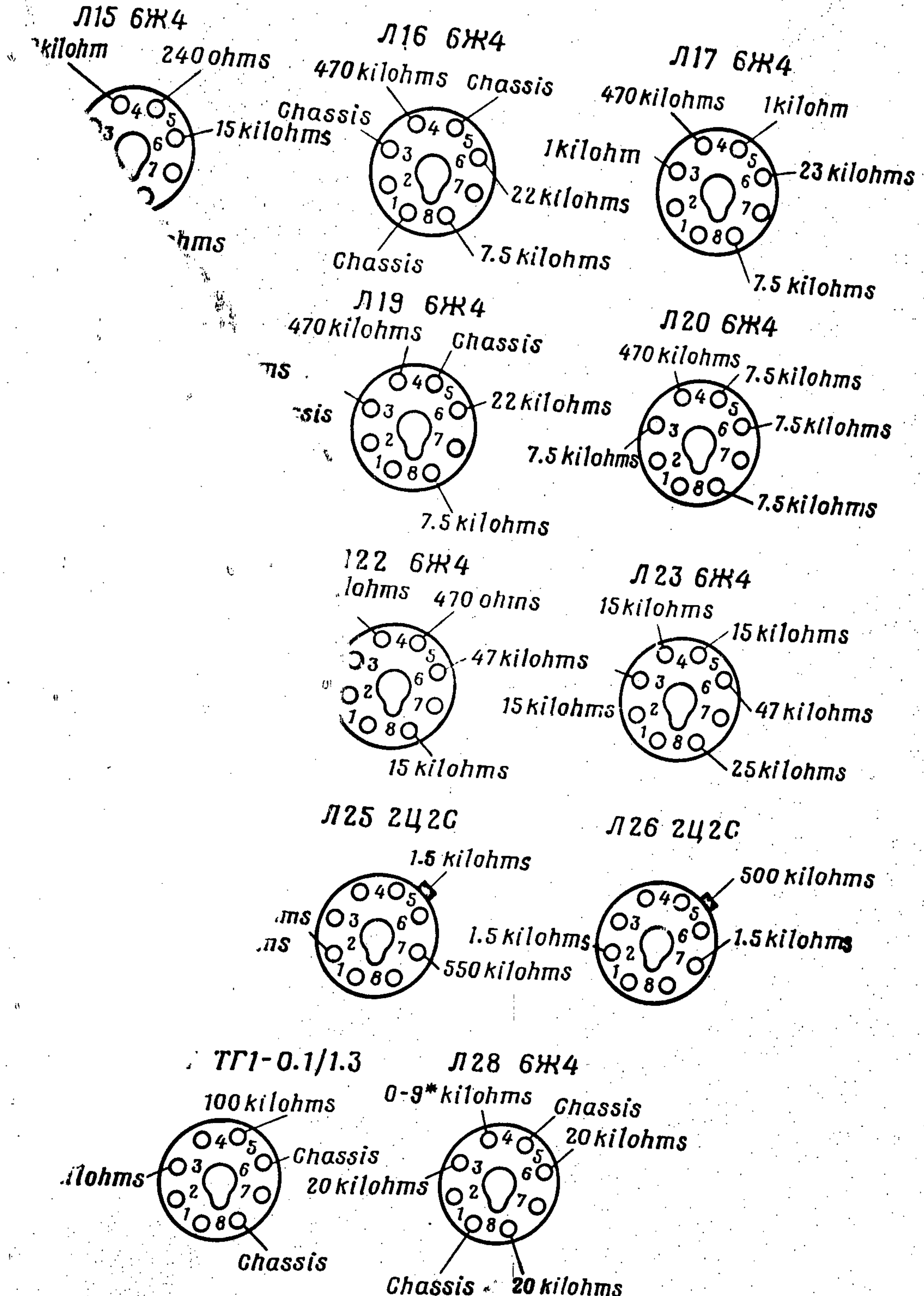
Unit СБ-50



ih master switch at BLANK, MID

50X1-HUM

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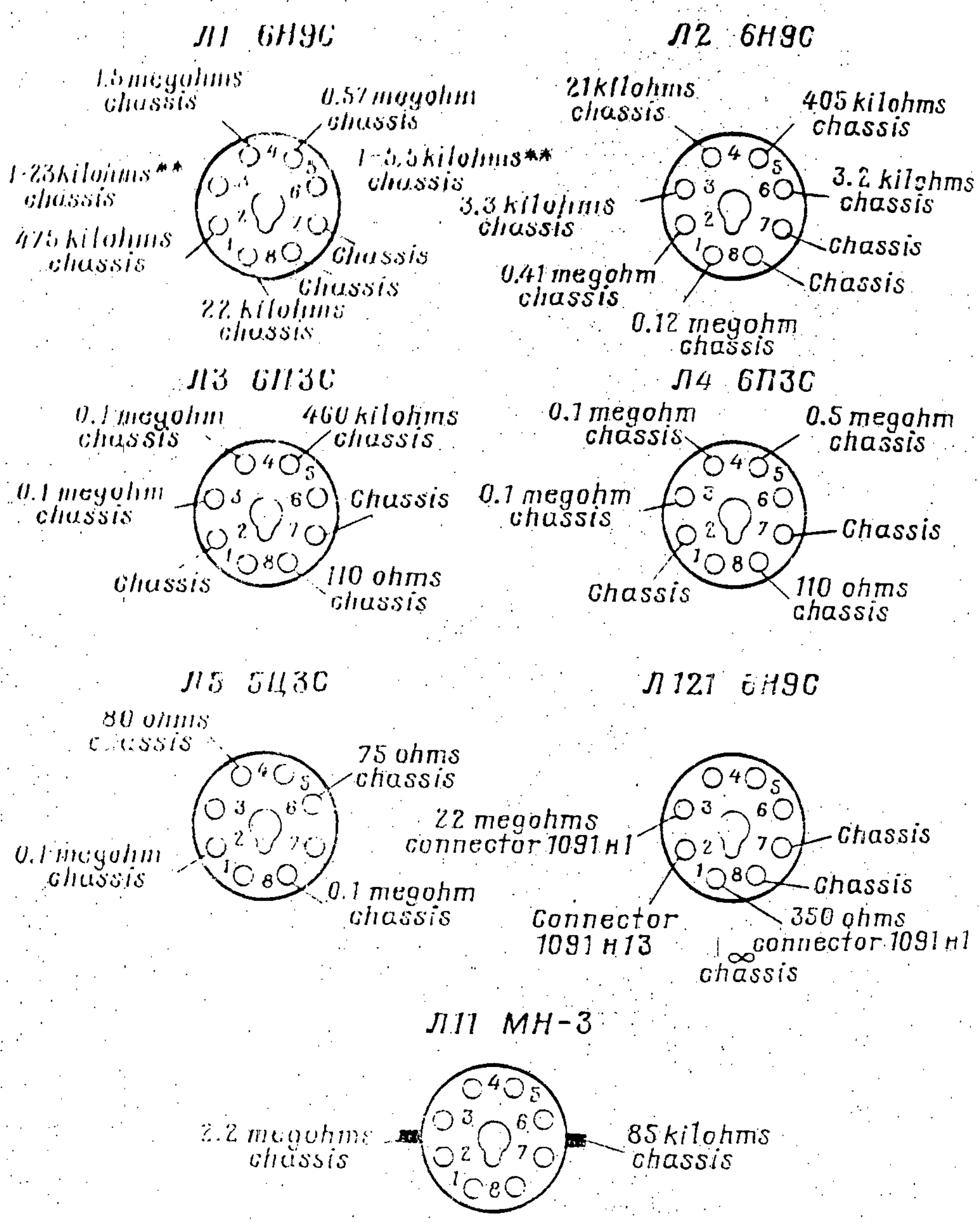
Unit XA-01



** Variable resistors 57 and 58 in key diagram of unit

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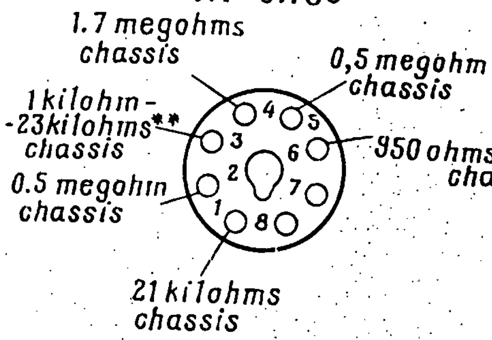
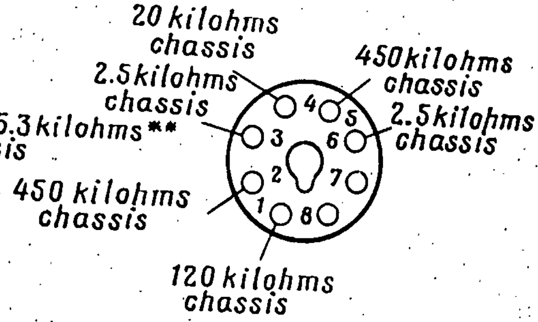
Unit УС-02

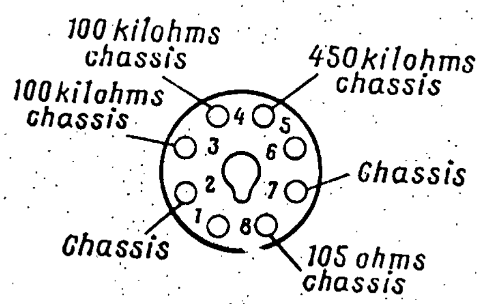
Л1 6Н8С



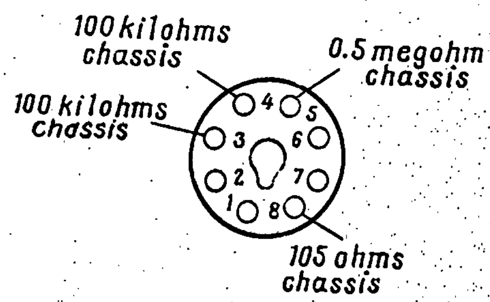
Л2 6Н8С



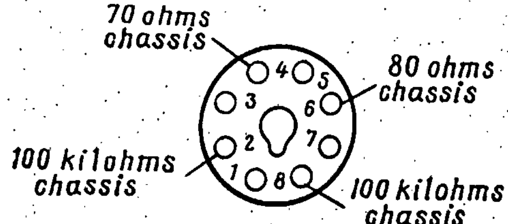
Л3 6П3С



Л4 6П3С



Л5 5Ц4С



** Variable resistors 57 and 58 in key diagram of unit

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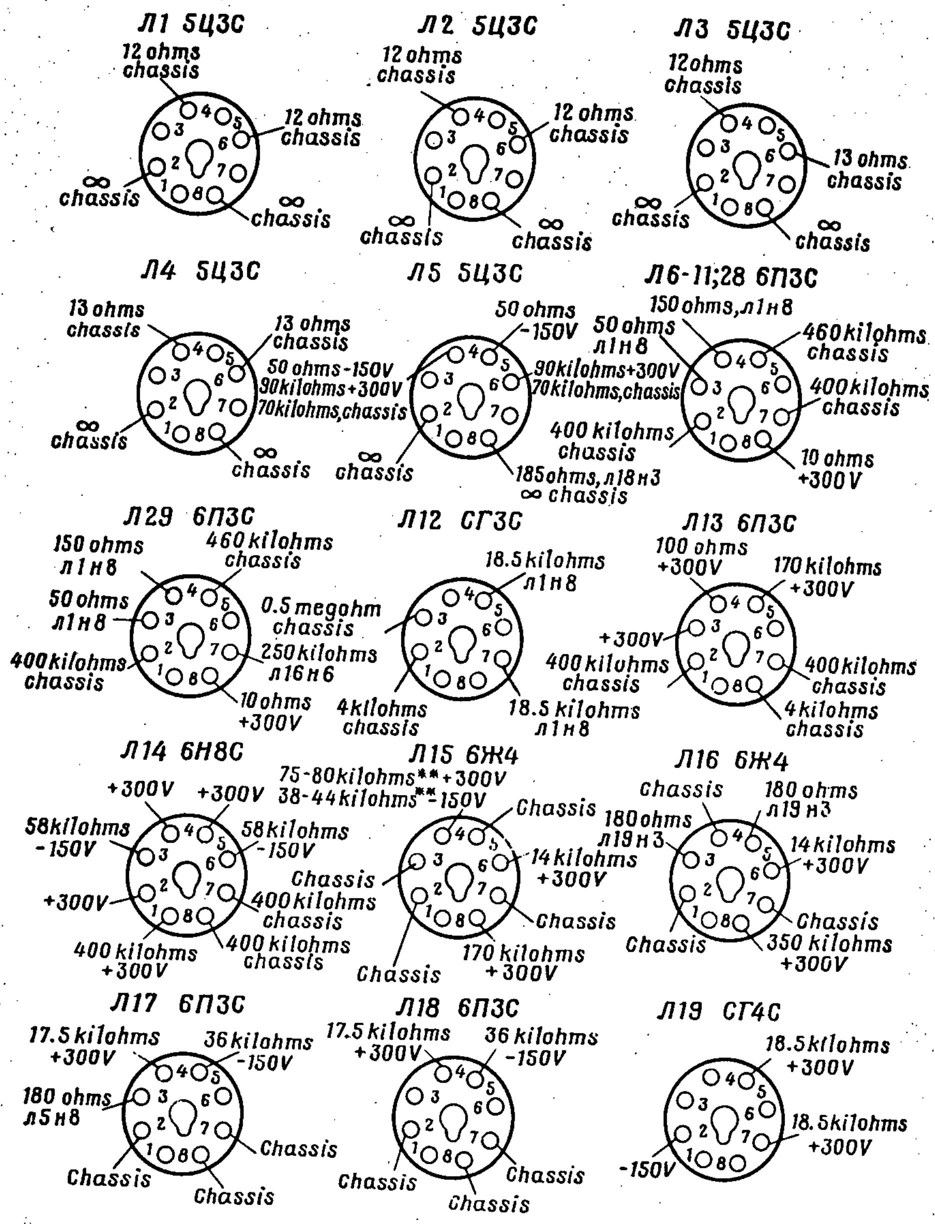
50X1-HUM

Unit БП-01



** See footnote on next page

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50X1-HUM

Unit БП-01

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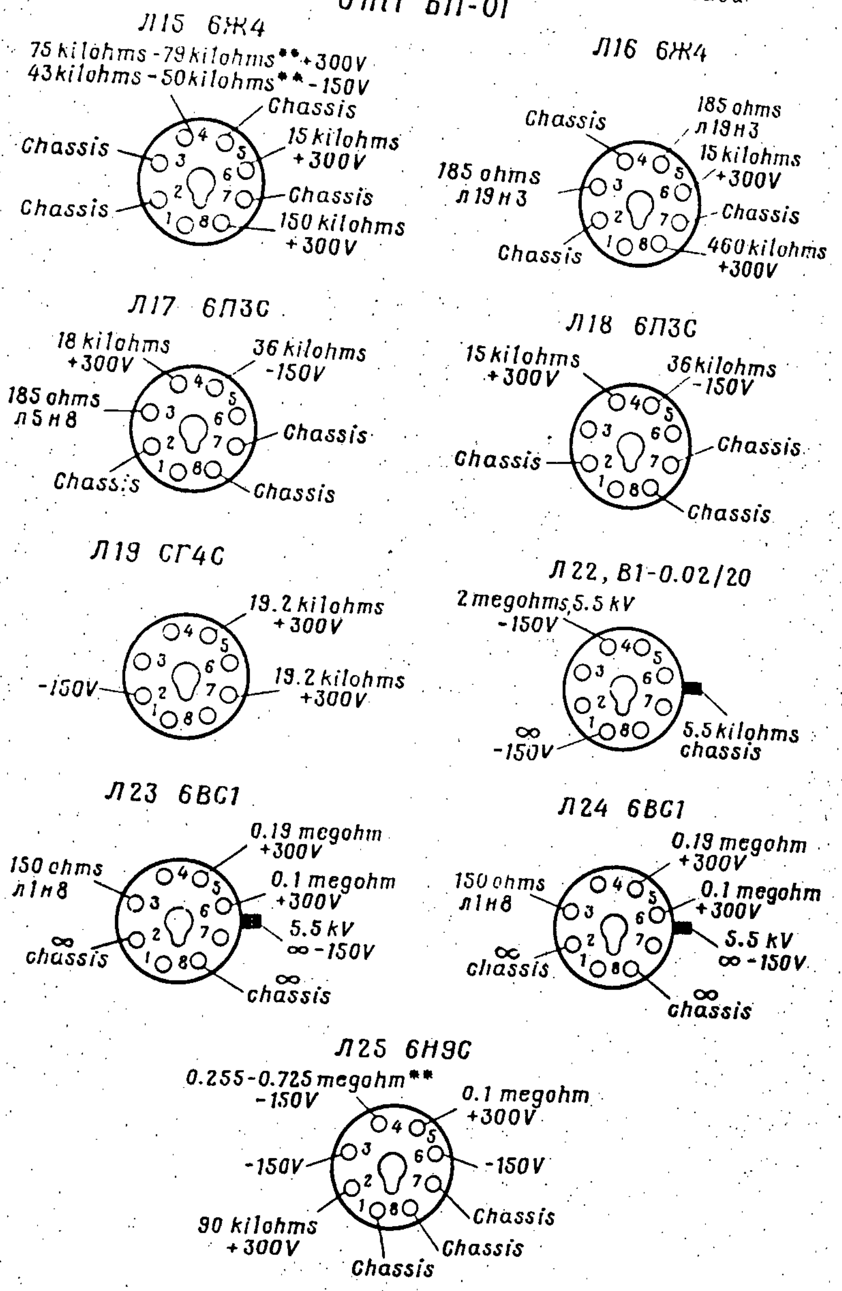

** Variable resistors in valve circuits of unit

Valve numbers in key diagram	Л-15	Л-25
Types	6Ж4	6Н9С
Numbers of variable resistors in key diagram	110	111

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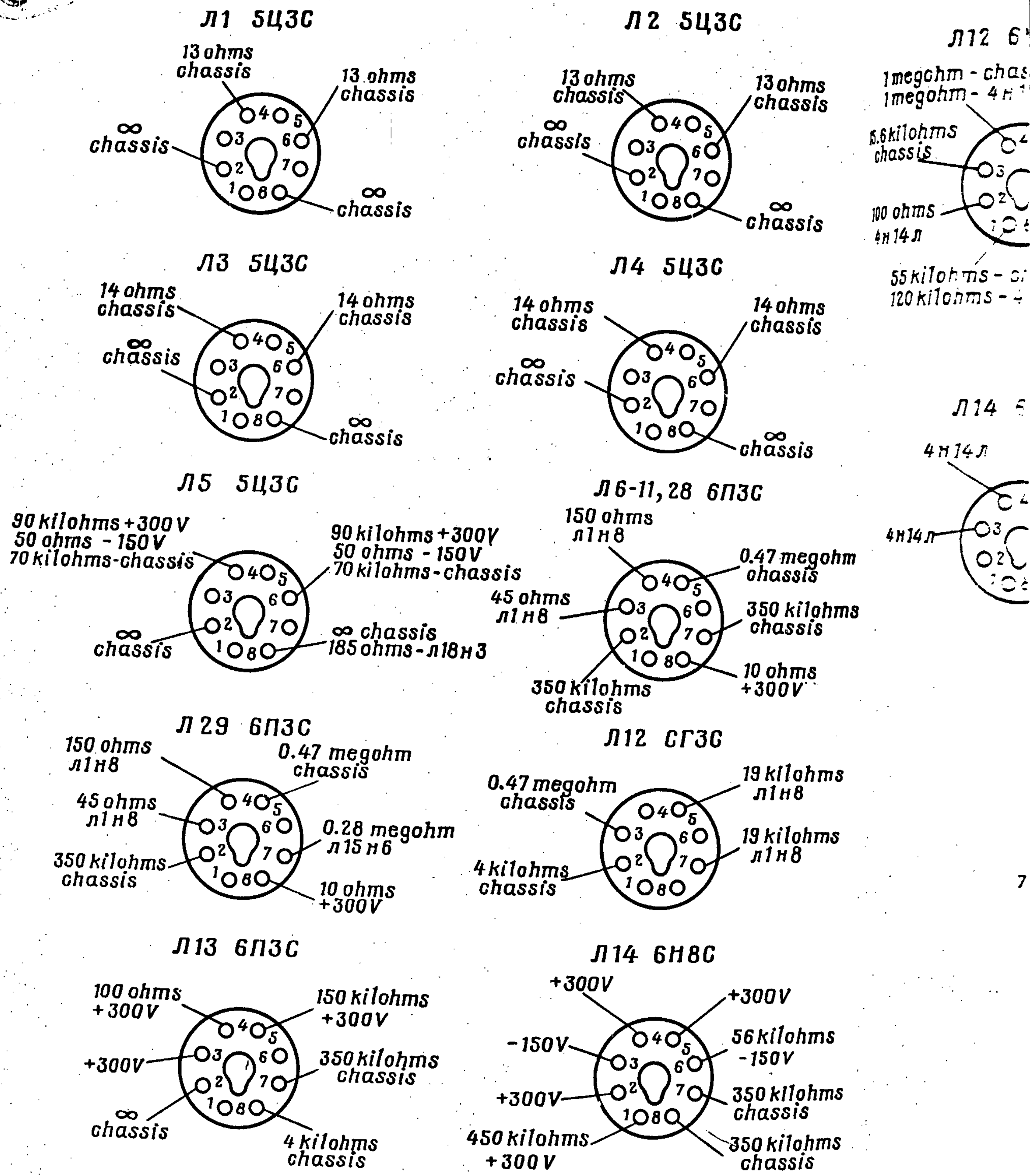
Unit БП-02



7

** Variable resistor 180 in key diagram of unit

Unit ИВ-01

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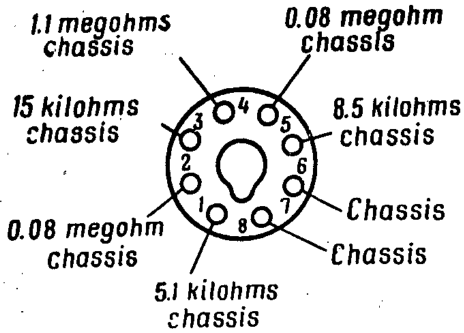
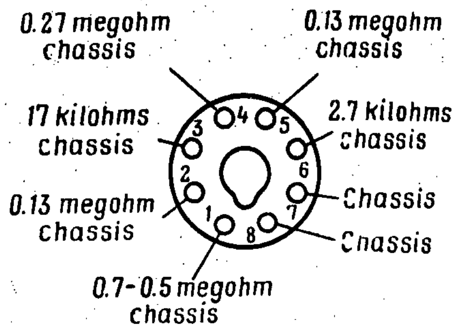
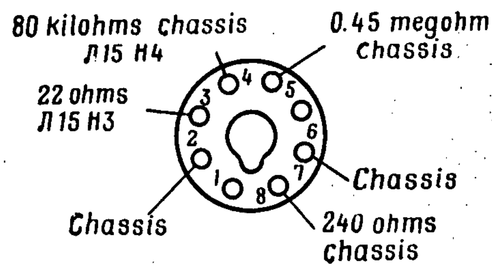
Л12 6Н8С



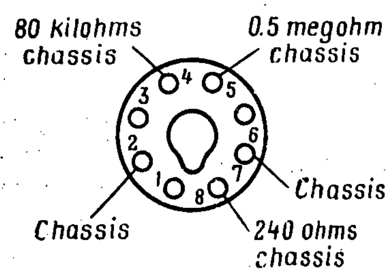
Л13 6Н8С



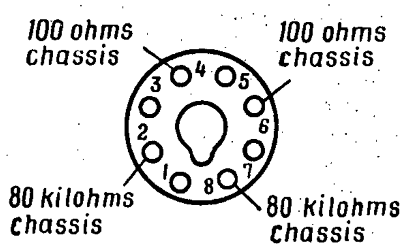
Л14 6П3С



Л15 6П3С



Л16 5Ц4С



** Variable resistor 125 in key diagram of unit

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LIST OF V

e of valve and
its number
key diagram

1

binet of Rad
equency ...

netron МИ-22,
, 89, 25, 25
(valve 1)
n lamp МН-3 (
iature valve

Main Transmit
Unit ФД-01

iature valve

Echo Signal
ceiver Unit

ystron К-11 (

dio-frequenc
6Ж1П (valv
3, 4, 5, 6,
and 9)

50X1-HUM

APPENDIX II

LIST OF VALVES EMPLOYED IN UNITS OF STATION

Name of valve and its number in key diagram	Basing	Service life in hrs	Number of valves in unit
1	2	3	4
<u>inet of Radio uency ША-02</u>			
on МИ-22,), 25, 26 e 1)	-	200	1
mp МН-3 (valve 2)	-	300	1
re valve	-	100	1
<u>Transmitter uit ФД-01</u>			
ture valve	-	100	1
<u>Echo Signal</u> <u>ceiver Unit ЕЭ-02</u>			
Klystron K-11 (valve 19)	9 - reflector; 10 - resonator; 6 - grid; 3 - cathode; 2, 7 - filament	250	1
Radio-frequency pentode 6Ж1П (valves 1, 2, 3, 4, 5, 6, 7, 8 and 9)	1 - control grid; 2, 7 - cathode and suppressor grid; 3,4 - filament; 5 - anode; 6 - screen grid	500	9

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1	2	3	4
Radio-frequency pentode 6Ж4 (valves 10, 11, 13 and 23)	4 - control grid; 6 - screen grid; 3 - suppressor grid; 8 - anode; 5 - cathode; 2, 7 - filament	500	4
Double diode 6X6C (valves 12 and 17)	3, 5 - anodes; 4, 8 - cathodes; 2, 7 - filament	500	2
Double triode 6H9C (valve 16)	1, 4 - grid; 2,5 - anode; 3,6 - cathodes; 7,8 - filament	500	1
Beam tetrode 6П3С (valves 18 and 22)	5 - control grid; 4 - screen grid; 3 - anode; 8 - cathode; 2,7 - filament	500	2
Thyratron ТГ1-0.1/1.3 (valve 14)	3 - anode; 5 - control grid; 6 - screen grid; 8 - cathode	200	1
Thyratron ТГ1-0.1/0.3 (valve 15)	5 - grid; 3 - anode; 8 - cathode; 2,7 - filament	200	1
Stabilovolt СГ3С (valve 20)	5 - anode; 2 - cathode; 3,7 - jumper	500	1
Stabilovolt СГ4С (valve 21)	5 - anode; 2 - cathode; 3,7 - jumper	500	1
Miniature valve	-	100	1

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1	2	3	4
Receiver Supply Unit БК-01			
Kenotron 5Ц4С (valves 1, 2 and 3)	4, 6 - anodes; 2, 8 - cathode and filament of valves	500	3
Miniature Valve	-	100	1
Ignition Voltage Rectifier ЯП-01			
..gh voltage ..otron 2Ц2С ..e 1)	2, 7 - cathode and filament, anode output - upper	500	1
..e valve	-	100	1
..ontrol ..ЩУ-02			
..МН-3 .., 2, 3, ..6)	-	300	6
..Control ..-02			
МН-3 ..7, 8, 9, and 12)	-	300	6
Position ..cator ИО-02			
..le-ray tube ..ЛМ32 (valve 1)	-	-	1

1	2	3	4
Double triode 6H8C (valves 3, 5, 11, 15, 18 and 25)	1, 4 - grids; 2, 5 - anodes; 3, 6 - cathodes; 7, 8 - filament	500	6
Double triode 6H7C (valves, 4, 9 and 6)	4, 5 - grids; 3, 6 - anodes; 8 - cathode; 2, 7 - filament	500	3
Double diode 6X6C (valves 7, 10, 12 and 16)	3, 5 - anodes; 4, 8 - cathodes; 2, 7 - filament	500	4
Beam tetrode 6П3С (13, 14, 26 and 34)	5 - control grid; 3 - anode; 8 - cathode; 2, 4 - screen grids; 7 - filament	500	4
Radio-frequency pentode 6Ж4 (valves 17, 19, 20, and 21)	4 - control grid, 6 - screen grid; 3 - suppressor grid; 8 - anode; 5 - cathode; 2, 7 - filament;		
Beam tetrode 6П3С (valve 42)	3 - anode; 4 - screen grid; 5 - control grid; 8 - cathode; 2, 7 - grids	500	1
Heptode 6A7 (valve 2)	5 - first control grid; 8 - second control grid; 4 - screen grid; 1 - suppressor grid; 3 - anode; 6 - cathode; 2, 7 - filament	500	1

1	2	3	4
<u>Range and Azimuth Indicator ВО-01</u>			
Cathode-ray tube 31ЛМ32 (valve 1)	-	-	1
Double triode 6Н8С (valves 3,11,15,18, 25,27,28 and 29)	1, 4 - grids; 2, 5 - anodes; 3, 6 - cathodes, 7, 8 - filament	500	8
Double triode 6Н7С (valves, 4,9,6,48, 49 and 51)	4, 5 - grids; 3, 6 - anodes; 8 - cathode; 2, 7 - filament	500	6
Double diode 6Х6С (valves 10, 12, 16 and 50)	3, 5 - anodes; 4, 8 - cathodes; 2, 7 - filament	500	4
Beam tetrode 6П3С (valves 13, 14, 30, 31, 34 and 42)	5 - control grid; 4 - screen grid; 3 - anode; 8 - cathode; 2, 7 - filament	500	6
Radio-frequency 6Ж4 pentode (17, 19, 20 and 21)	4 - control grid; 6 - screen grid; 3 - suppressor grid; 8 - anode; 5 - cathode; 2, 7 - filament	500	4
Heptode 6А7 (valve 2)	5 - first control grid; 8 - second control grid; 4 - screen grid; 1 - suppressor grid; 3 - anode; 6 - cathode; 2, 7 - filament	500	1

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1	2	3	4
Height Indicator HO-02			
Cathode-ray tube 31ЛМ32 (valve1)	-	-	1
Double triode 6Н8С (valves 5, 11, 15, 18, 25, 27, 28, 40, 33 and 43)	1, 4 - grids, 2, 5 - anodes; 3, 6 - cathodes; 7, 8 - filament	500	10
Double triode 6Н9С (valves 22, 23 and 38)	1 , 4 - grids; 2, 5 - anodes; 3, 6 - cathodes; 7, 8 - filament	500	3
Double triode 6Н7С (valves 9, 6, 48, 49 and 5)	4, 5 - grids; 3, 6 - anodes; 8 - cathode; 7, 2 - filament	500	5
Double diode 6Х6С (valves 10, 12, 44, 16, 50, 37 and 24)	3, 5 - anodes; 4, 8 - cathodes; 2, 7 - filament	500	7
Beam tetrode 6П3С (valves 13, 14, 45, 46, 34)	5 - control grid; 4 - screen grid; 3 - anode; 8 - cathode; 2, 7 - filament	500	5
Beam tetrode 6П6С (valves 42, 52 and 53)	5 - control grid; 4 - screen grid; 3 - anode; 8 - cathode; 2, 7 - filament	500	3
Radio-frequency pentode 6Ж4 (valves 17, 19 and 20)	4 - control grid; 6 - screen grid; 3 - suppressor grid; 8 - anode; 5 - cathode; 2, 7 - filament	500	3

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50X1-HUM

1	2	3	4
Radio-frequency pentode 6П9 (valves 41)	4 - control grid; 6 - screen grid; 1 - suppressor grid; 8 - anode; 5 - cathode; 2, 7 - filament	500	1
1500 c.p.s. Voltage Generator ГА-01			
Double triode 6Н8С (valves 12 and 13)	1, 4 - grids; 2, 5 - anodes; 3, 6 - cathodes; 7, 8 - filament	500	2
Beam tetrode 6П3С (valves 14 and 15)	3 - anode; 4 - screen grid; 5 - control grid; 8 - cathode; 2, 7 - filament	500	2
Kenotron 5Ц4С (valve 16)	4, 6 - anodes; 8 - filament - cathode; 2 - filament	500	1
Miniature valve	-	100	1
Servo Amplifier Unit УС-02			
Double triode 6Н9С (valves 1 and 2)	1, 4 - grids; 2, 5 - anodes; 3, 6 - cathodes, 2, 7 - filament	500	2
Beam tetrode 6П3С (valves 3 and 4)	3 - anode; 4 - screen grid; 5 - control grid; 8 - cathode; 2, 7 - filament	500	2

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50X1-HUM

1	2	3	4
Kenotron 5Ц3С (valve 5)	4, 6 - anodes; 2, 8 - cathodes	500	1
Neon valve MH-3 (valve 11)	-	300	1
Miniature valve	-	100	3
Selsyn Repeater XA-01			
Double triode 6H9C (valves 1, 2 and 20)	1, 4 - grids; 2, 5 - anodes; 3, 6 - cathodes; 7, 8 - filament	500	3
Beam tetrode 6П3С (valves 3 and 4)	5 - control grid; 4 - screen grid; 3 - anode; 8 - cathode; 2, 7 - filament	500	2
Kenotron 5Ц3С (valve 5)	4, 6 - anodes; 2, 8 - cathodes	500	1
Neon valve MH-3 (valve 11)	-	300	1
Miniature valve	-	100	6
Antenna Turn Angle Marker Unit 3A-01			
Double diode 6X6C (valves 1 and 5)	3, 5 - anodes; 4, 8 - cathodes; 2, 7 - filament	500	2
Radio-frequency pentode 6Ж4 (valves 2 and 3)	8 - anode; 3 - suppressor grid; 6 - screen grid; 4 - control grid; 5 - cathode; 2, 7 - filament	500	2
Double triode 6H7C (valve 4)	3, 6 - anodes; 4, 5 - grids; 8 - cathodes; 2, 7 - filament	500	1

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1	2	3	4
Double triode 6H8C (valve 6)	2, 5 - anodes; 3, 6 - cathodes; 1, 4 - grids; 7, 8 - filament	500	1
Miniature valve	-	100	2
Azimuth Marker Unit ЖА-50			
Double triode 6H8C (valves 1, 3, 4, 5, 6, 7)	2, 5 - anodes; 3, 6 - cathodes; 1, 4 - grids; 7, 8 - filament	500	6
Double triode 6H7C (valve 2)	3, 6 - anodes; 4, 5 - grids; 8 - cathode; 2, 7 - filament	500	1
Beam tetrode 6П3C (valves 8, 9, 10)	3 - anode; 4 - screen grid; 5 - control grid; 8 - cathode; 2, 7 - filament	500	3
Neon valve MH-3 (valve 11)	-	-	1
Range Marker Unit ДА-01			
Cathode-ray tube 8Л029(valve 1)	1, 14 - filament; 2 - cathode; 3 - grid; 5 - first anode; 9 - second anode; 7, 8 - X-plates; 10, 11 - Y-plates.	400	1

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1	2	3	4
Double triode 6H8C (valves 2, 6, 7, 9, 10, 11, 13, 15, 18, 20, 21, 23,25, 26, 29, 31,32, 33, 34 and 35)	1, 4 - grids; 2, 5 - anodes; 3, 6 - oathodes; 7, 8 - filament	500	20
Double triode 6H7C (valves 3, 5, 14, 19, 24, 27 and 38)	4, 5 - grids; 3, 6 - anodes; 8 - oathode; 2, 7 - filament	500	7
Double diode 6X6C (valves 4, 8, 12, 17, 22 and 28)	3, 5 - anodes; 4, 8 - oathodes; 2, 7 - filament	500	6
High-voltage kenotron 2Ц2C (valve 36)	2, 7 - oathode and filament, anode output, upper	500	1
Radio-frequenoy pentode 6Ж4 (valve 30)	4 - control grid; 6 - soreen grid; 3 - suppressor grid; 8 - anode; 5 - oathode; 2, 7 - filament	500	1
Stabilovolt CГ4C (valve 37)	5 - anode; 2 - oathode; 3, 7 - jumper	500	1
Miniature valve	-	100	2
<u>Mixer CБ-50</u>			
Cathode-ray tube 8Л029 (valve 29)	3 - grid; 5 - first anode; 9 - seoond anode; 2 - oathode; 1, 14 - filament; 7, 8 - X-plates; 10, 11 - Y-plates	400	1

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1	2	3	4
Double triode 6H8C (valves 3, 2, 14, 24)	1, 4 - grids; 2, 5 - anodes; 3, 6 - cathodes; 7, 8 - filament	500	4
Double diode 6X6C (valves 1, 2, 13)	3, 5 - anodes; 4, 8 - cathodes; 2, 7 - filament	500	3
Radio-frequency pentode 6Ж4 (valves 4, 5, 6, 8, 9, 10, 11, 12, 15, 16, 17, 19, 20, 21, 22, 23, 28)	4 - control grid; 6 - screen grid; 3 - pentode grid; 8 - anode; 5 - cathode; 2, 7 - filament	500	17
Radio-frequency pentode 6H9 (valves 7 and 18)	4 - control grid; 6 - screen grid; 1 - suppressor grid; 8 - anode; 5 - cathode; 2, 7 - filament	500	2
High-voltage kenotron 2Ц2C (valves 25, 26)	2, 7 - cathode and filament, anode output, upper	500	2
Thyratron TГ1-0.1/1.3	8 - anode; 5 - control grid; 6 - screen grid; 8 - cathode	200	1
Miniature valve (valves 30 and 31)	-	100	2
<u>Antenna Rotation Simulator ИВ-01</u>			
Double triode 6H8C (valves 12 and 13)	1, 4 - grids; 2, 5 - anodes; 3, 6 - cathodes; 7, 8 - filament	500	2

1	2	3	4
Beam tetrode 6П3С (valves 14 and 15)	5 - control grid; 4 - screen grid; 3 - anode; 8 - cathode; 2, 7 - filament	500	2
Kenotron 5Ц4С (valve 16)	4, 6 - anodes; 2, 8 - cathode and filament	500	1
Neon valve МН-3 (valve 21)	-	300	1
Miniature valve	-	100	1
Supply Unit БП-01			
Kenotron 5Ц3С (valves 1, 2, 3, 4 and 5)	4, 6 - anodes; 2, 8 - cathodes	500	5
Kenotron В1-0.02/20 (valve 22)	4, 11 - cathode, anode output, upper	500	1
Beam tetrode 6П3С (valves 6, 7, 8, 9, 10, 11, 13, 17, 18 and 19)	5 - control grid; 4 - screen grid; 3 - anode; 8 - cathode; 2, 7 - filament	500	10
Double triode 6Н8С (valve 14)	1, 4 - grids; 2, 5 - anodes; 3, 6 - cathodes; 7, 8 - filament	500	1
Double triode 6Н9С (valve 25)	1, 4 - grids; 2, 5 - anodes; 3, 6 - cathodes; 7, 8 - filament	500	1
Radio-frequency pentode 6Ж4 (valves 15 and 16)	4 - control grid; 6 - screen grid; 3 - suppressor grid; 8 - anode; 5 - cathode; 2, 7 - filament	500	2
High-voltage tetrode ЛО-731а (valves 23 and 24)	7 - cathode; 5 - modulator; 3 - acceleration electrode; 2, 8 - filament, anode output - at the top of envelope	500	2

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3	4
500	1
	1
	2
00	1
500	1
100	2

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APPENDIX III

LIST OF OPERATING SET OF VALVES

Name and type of valve	Number of valves in operation
1	2
Magnetron МИ-22(24, -25, -26, -89)	5
Klystron К-11	5
Cathode-ray tube 8Л029	2
Cathode-ray tube 31ЛМ32	4
Double triode 6Н8С	109
Double triode, 6Н9С	20
Same, 6Н7С	30
Beam tetrode 6П3С	118
Same, 6П6С	1
High-voltage tetrode ЛО-731а	8
Radio-frequency pentode 6Ж4	60
Radio-frequency pentode 6П9	8
Radio-frequency pentode 6Ж1П	54
Heptode 6А7	4
Double diode 6Х6С	47
Kenotron 5Ц4С	17
Same, 5Ц3С	37
High-voltage kenotron 2Ц2С	8
High-voltage kenotron В1-0.02/20	4
Thyratron ТГ1-0.1/1.3	6
Same, ТГ1-0.1/0.3	5
Stabilovolt СГ3С	13
Stabilovolt СГ4С	14
Neon lamp МН-3	16
Miniature valve 13.5 V; 0.18 A	58
Miniature valve 6.3 V; 0.18 A	7

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APPENDIX IV

FREQUENCY AMPLIFIER
ALVE

avelling
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frequency

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nstalled
ficate. The
tal plate
or output.

-140 to ON.
g from the tester,
rectional coupler on
SECRET up the union nut. Connect
alibrate it for measuring
ency operation as directed
th the tester, type PT-10;
transmitter equipment for BLOWING
sting screw on the front panel
certificate value of the filament

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voltage by the upper scale of the DUTY CHECK instrument by placing the switch of this instrument to FILAMENT;

(c) check the solenoid currents by placing the DUTY CHECK switch to SOLENOID CURRENT. In this case the solenoid current should be within 0.79 - 0.85 A when the equipment is cold and should not drop below 0.63 A when the equipment is warm.

If the solenoid current differs from the given values, it should be adjusted. The adjustment is carried out when the equipment is not yet warmed up, in this case the current should be within the range of 0.79 - 0.85 A.

To change the solenoid current, shift the clamp of the dropping resistor employed in unit БП-52 but first disconnect the unit from the circuit.

When the clamp is pushed back, the solenoid current is increased;

(d) using the FOCUS and ANODE I adjusting screws and placing the DUTY CHECK switch in the corresponding positions set the certificate voltage values on the focusing electrode (the voltage on the control electrode) and on the first anode of valve УВ-1М;

(e) rotating in turn the external and internal front eccentrics until the minimum current value of the second anode is obtained, centre valve УВ-1М in unit МВ-50; in this case the current value of the second anode should not exceed 5 μA. The currents of the second anode are checked with the instrument of unit БП-140. The switch of the instrument should be turned to CURRENT OF ANODE II.

If the valve cannot be centred by means of the front eccentrics, make use of the rear pair of eccentrics, turning them until the required value of the second anode current is obtained;

(f) turn the transmitter switches to ON and check the AFC system for proper functioning. Connect the instrument for 100 μA with jack plug into the 2nd DETECTOR monitoring jack of the echo signal receiver ПЭ-02.

ver controls: the LGC - RGC switch to LGC
ch to AFC;
ltage at the second anode of the valve
ing screw so as to increase its value
al clockwise) set the voltage at the
first noise maximum at the out-
ector;
f the tester PT-10 try to
he receiver second detector.
tester make sure that
he transmitter but not
differs from the

k-gap in the
he magnetron
tube) by the
second detector;
synchronized
aximum sensitivity
ot change the
unit;

sivity values
n the Service
tolerance limits
cusing electrode
tage across
In this case the
t exceed 500 μA.

YB-1M

ver-transmitter equipment;

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(b) screw off the union nut of the front centring device of unit MB-50;

(c) pull out valve УВ-1М together with the front centring device;

(d) pull out the old УВ-1М valve from the panel and insert a new one;

(e) mount valve УВ-1М into the unit and tighten up the union nut of the front centring device;

(f) tune the radio-frequency amplifier as directed in the present Instructions and in the Certificate for Valve for Valve УВ-1М.

4. Possible Troubles and Remedies

Symptom	Cause	Remedy
1. No current in commutator. It does not appear during centring the valve.	No magnetic field of solenoid.	Check rectifier БП-52 and connection cables.
2. While setting ANODE switch to CURRENT OF ANODE II and COMMUTATOR positions the tester pointer overshoots.	If this occurs at the certificate voltage of valve УВ-1М, it is caused by short circuit inside valve.	Replace valve УВ-1М.
3. Noise at receiver output unstable.	If it disappears when ANODE voltage on the БП-140 is cut out, then valve УВ-1М is excited.	Thoroughly set voltage at second anode (spiral) of valve УВ-1М.

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use	Remedy
heater of 1M is burnt.	Replace valve YB-1M.

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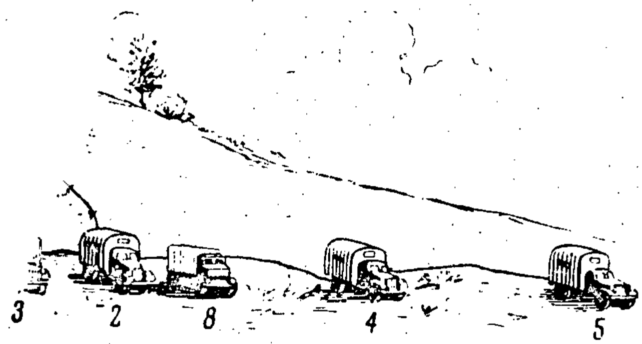
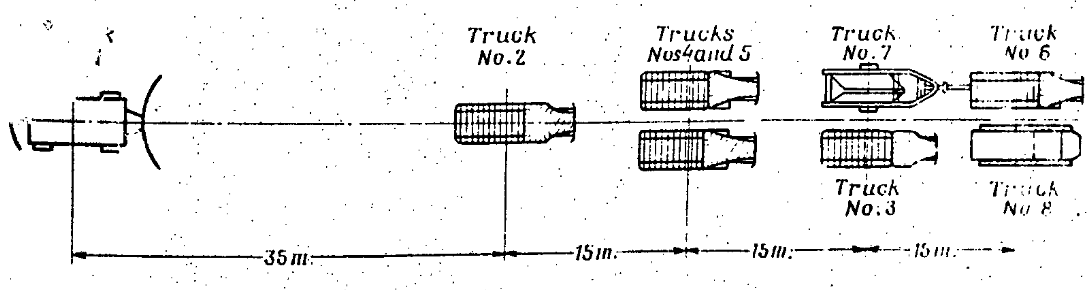


. 1. Radar Station П-20 Set up for Operation
.ving-transmitting cabin, 2 - truck with display
3 - truck with plan position indicator repeater;
power plants; 6 - antenna carrying truck; 7 - two-wheel
.iler for carrying antenna; 8 - truck-tractor; 9 - junction
cables.



F i g. 2. Tentative Lay-Out of Trucks of Radar Station П-20

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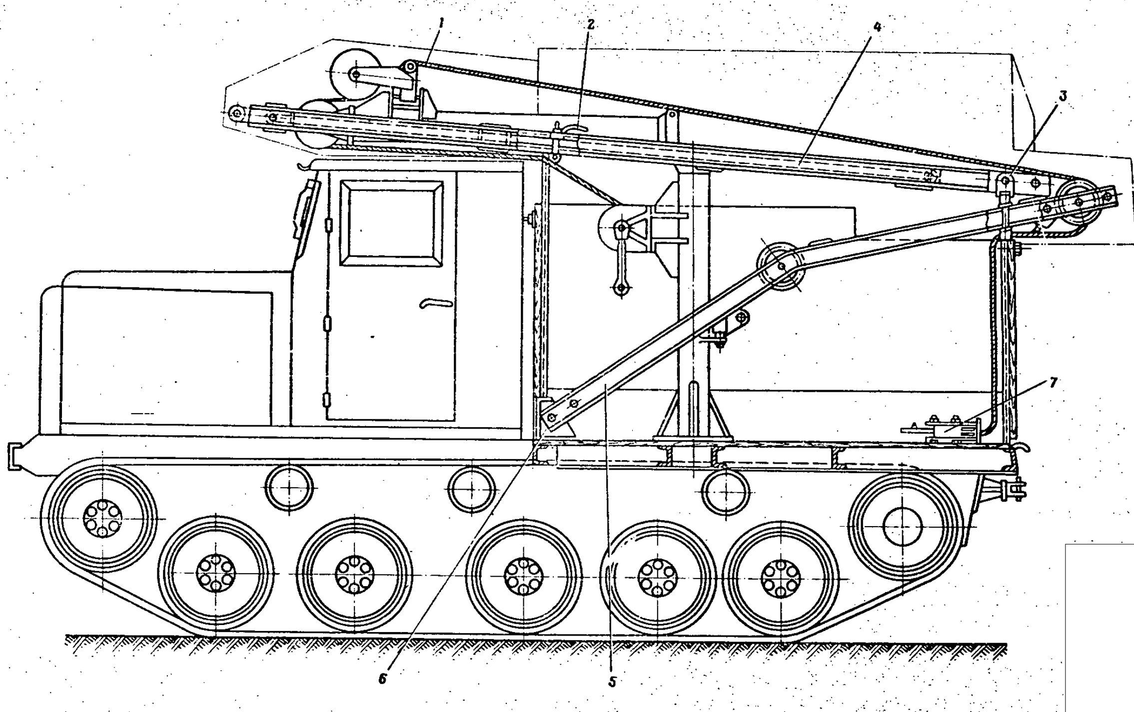

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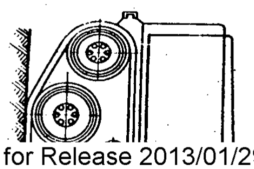
F i g. 3. Arrangement of Crane on Truck-Tractor
1 - rope; 2 - pivoted bolt nut of front support; 3 - pin for fastening jib to rear support; 4 - lower section of jib; 5 - upper section of jib; 6 - knee-plate; 7 - hook suspension.

F i g.
1 - truck-tra
winch; 4 - ji
6 - lower pul
lower section
upper section
13 - hook; 1



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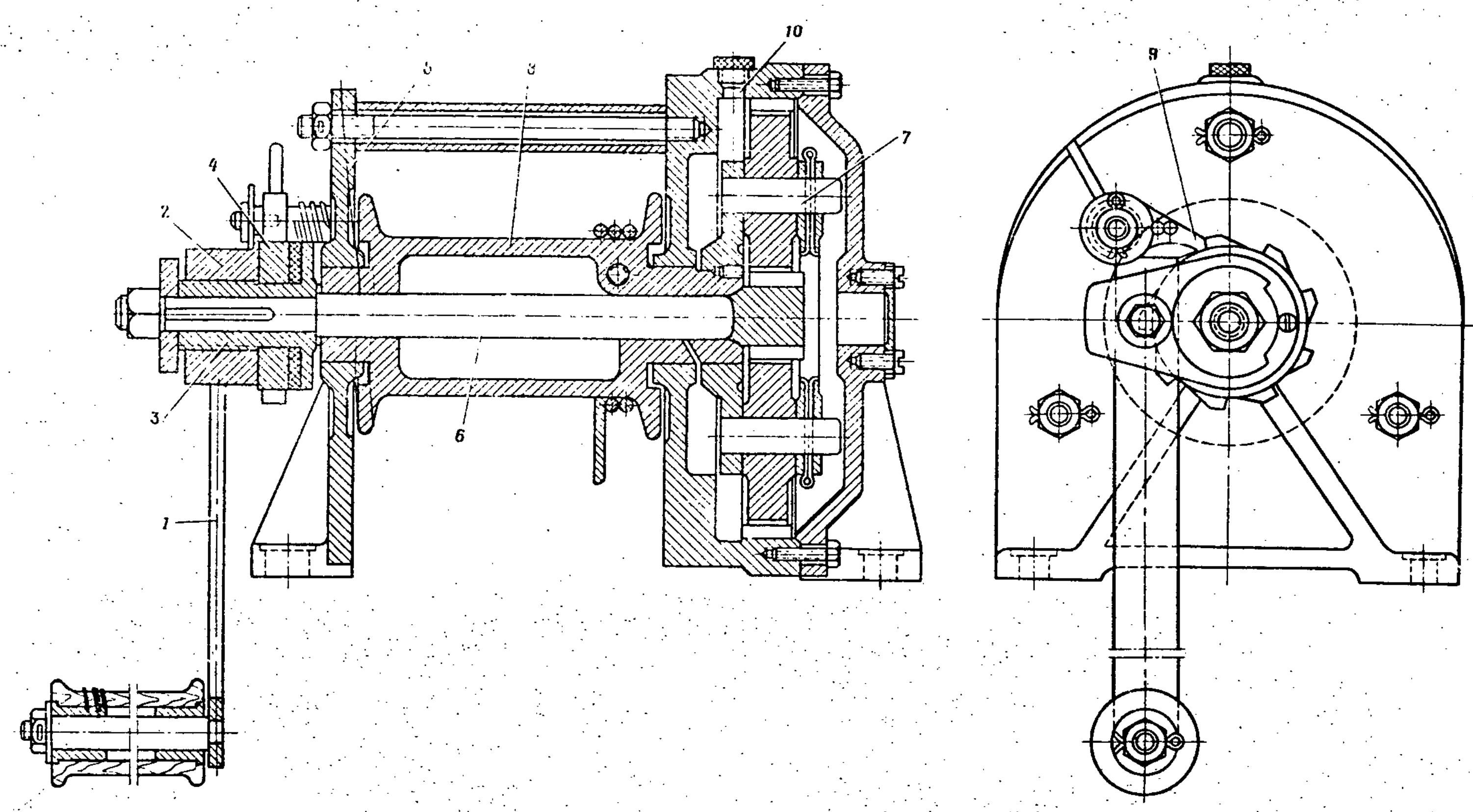

F i g. 5. Design of Crane Planetary Gear Winch
1 - winch handle; 2 - hub; 3 - screw; 4 - ra chet; 5 - face-plate of handle screw; 6 - shaft-gear; 7 - planetary gear; 8 - cylinder; 9 - pawl; 10 - grease fitting.

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1 ...
of ve... ...am
antenna ... ...winging
mechanism (th... ... can with
oil; 7 - rope for ... middle section
of vertical-beam antenna ... ...ccessories for interrogator HP3-1 ; 10 - antenna hoist of interrogator HP3-1 ; 11 - case with accessories for interrogator HP3-1 ; 12 - antenna of interrogator HP3-1 ;

13 - can with oil.

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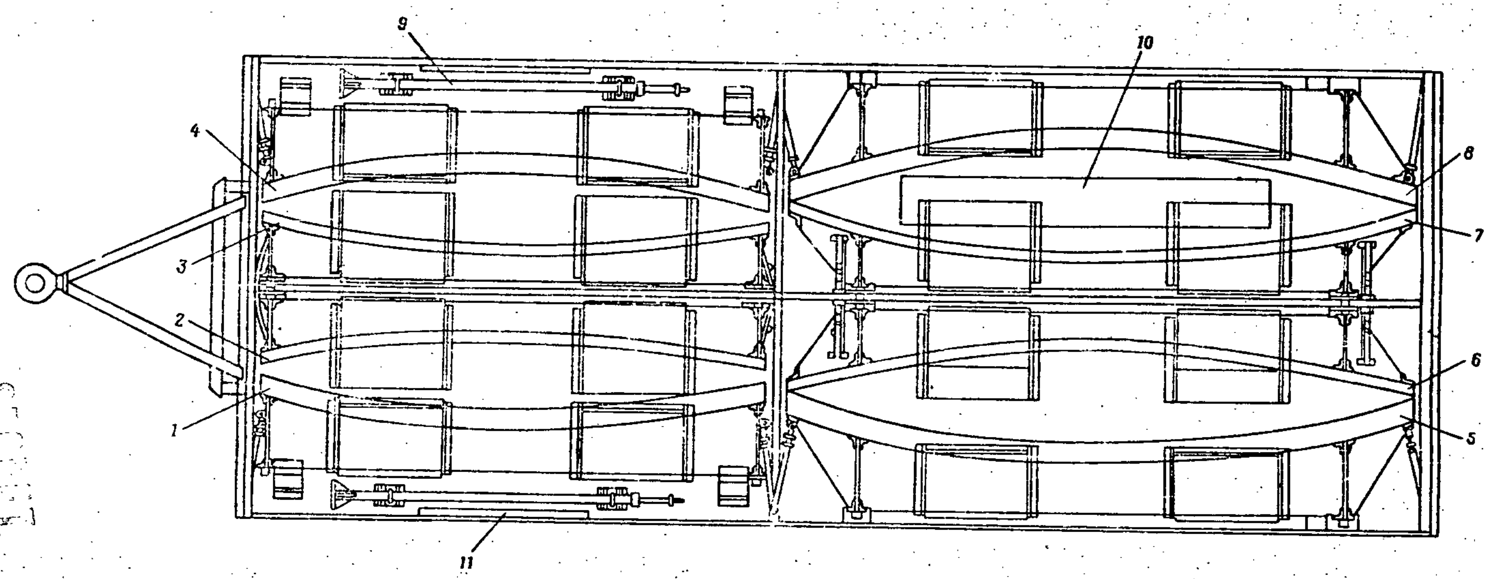

F i g. 7. Arrangement of Antenna System Assemblies on Two-Wheel Trailer
1 - end section of slant-beam antenna reflector; 2 - middle section of slant-beam antenna reflector; 3 - middle section of slant-beam antenna reflector; 4 - end section of slant-beam antenna reflector; 5 - end section of vertical-beam antenna reflector; 6 - middle section of vertical-beam antenna reflector; 7 - middle section of vertical-beam antenna reflector; 8 - end section of vertical-beam antenna reflector; 9 - rests; 10 - antenna of interrogator HP3-1; 11 - waveguide suspension.

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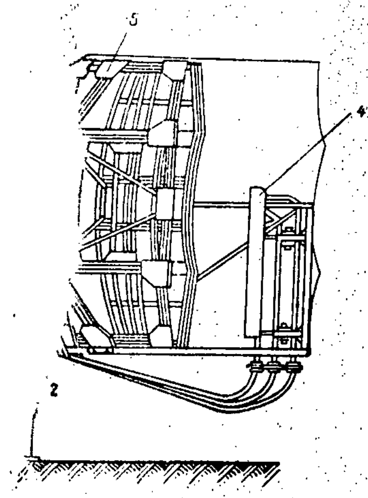

or Operation
nna reflector;
antenna reflector;
- vertical-beam re-
eflector; 6 - slant-beam
of slant channel wave-
of vertical channel wave-
of slant-beam reflector
ening bar of vertical-beam
ame of slant-beam reflector.

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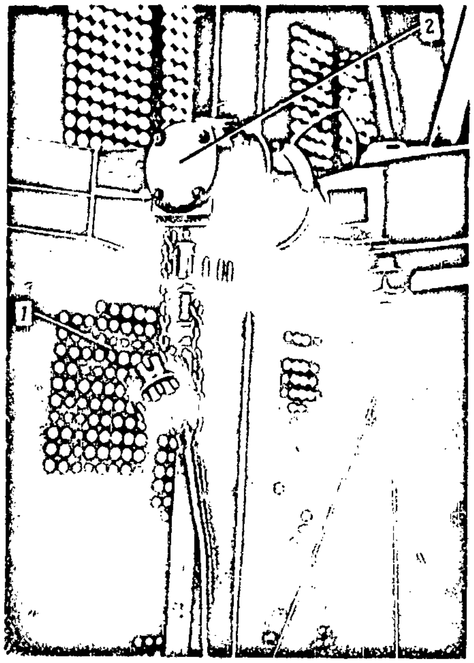
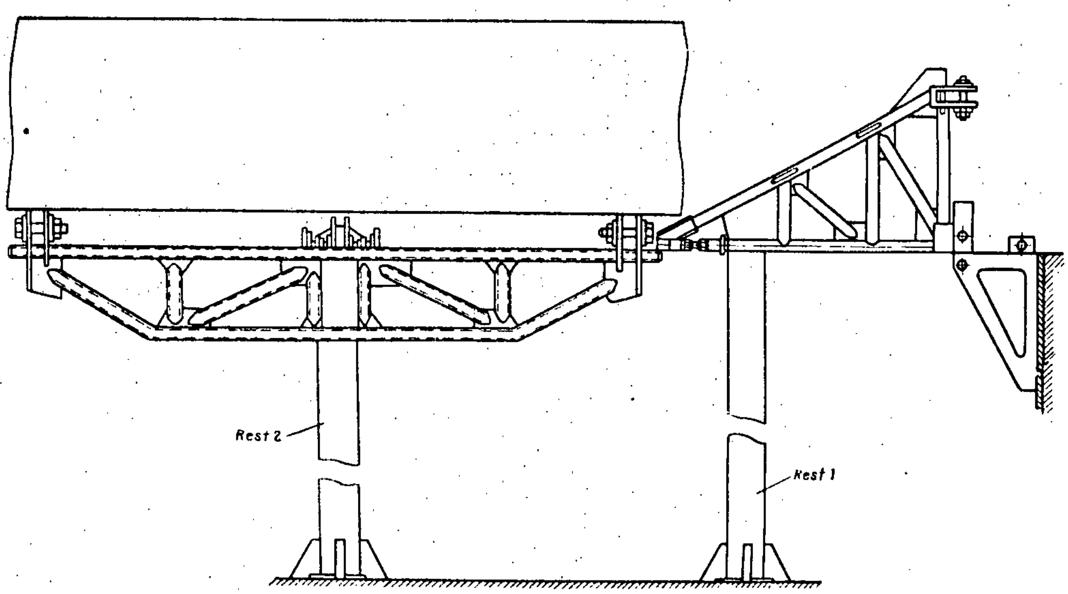


F i g. 9. Installation Place of Vertical-Beam Reflector Transmitting Selsyn
1 - vertical-beam reflector; 2 - transmitting selsyn.



F i g. 10. Installation of Vertical-Beam Reflector and Its Fastening Frame on Rests

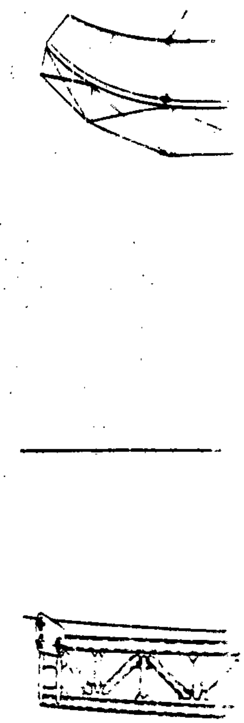


Fig. 12 Fastenin-
Ref

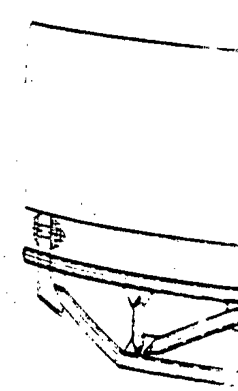
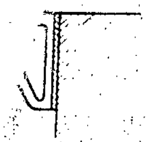
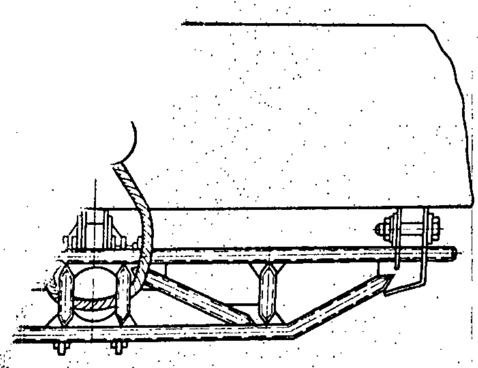


Fig. 1[illegible]. Hoisting

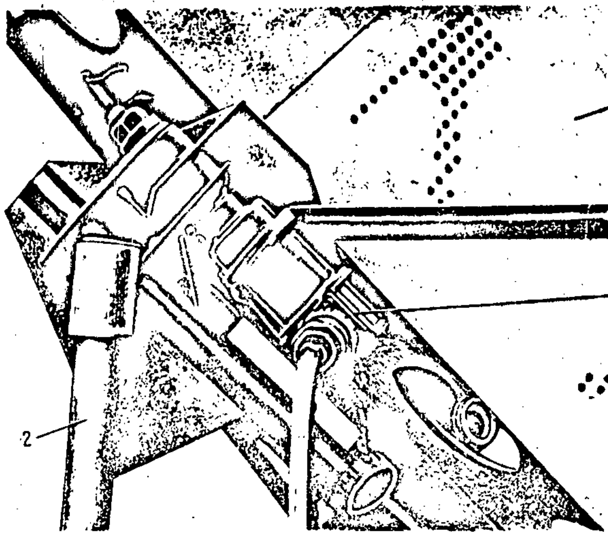
F i g. 11. Hoisting of Slant-Beam Reflector On Four Strops



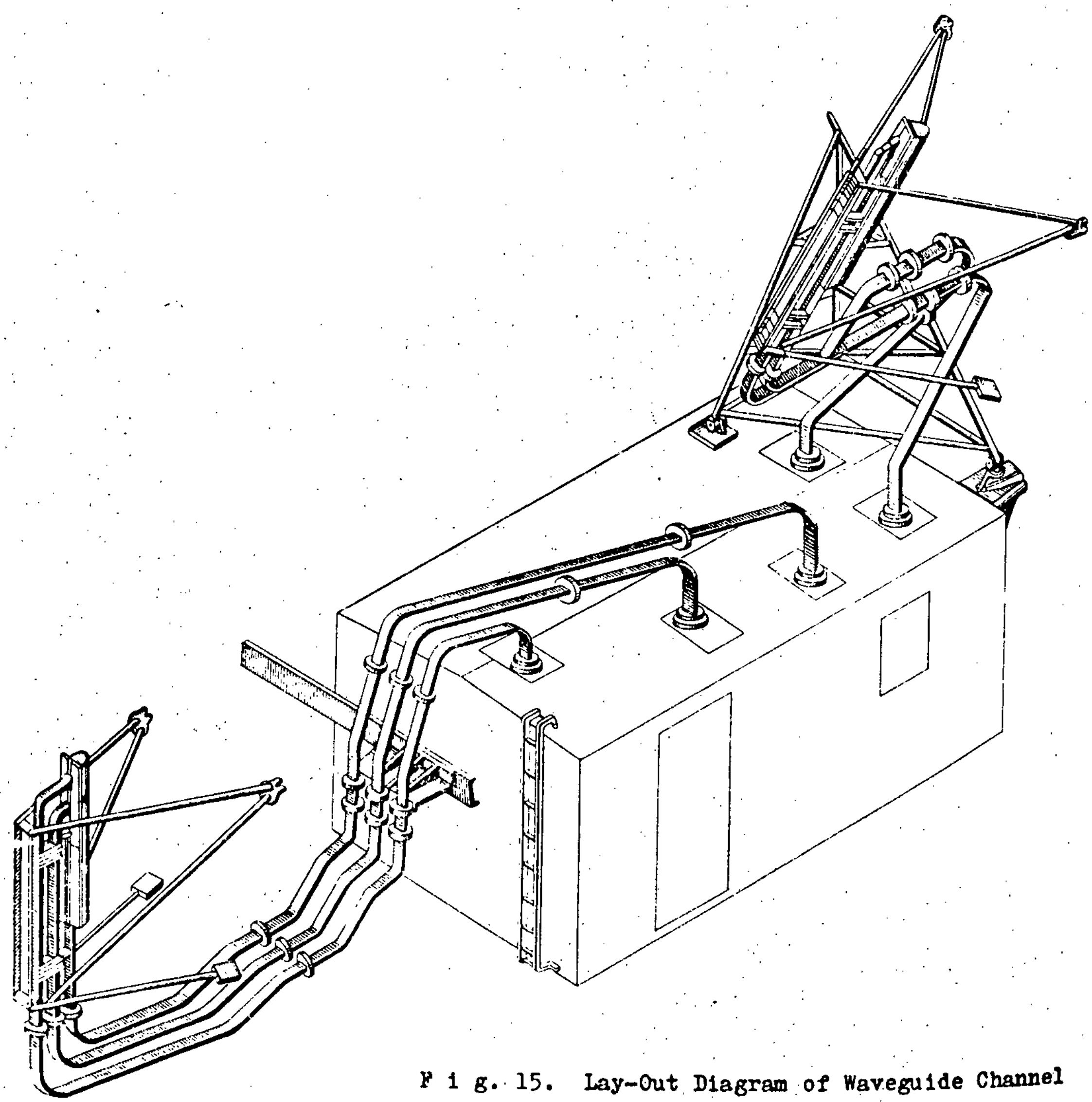
of Slant-Beam



ing of Slant-Beam Reflector with Short Rope



F i g. 14. Installation Place of Slant-Beam Reflector Transmitting Selsyn
1 - slant-beam reflector; 2 - tran mitting selsyn; 3 - fastening fram of slant-beam reflector.



F i g. 15. Lay-Out Diagram of Waveguide Channel

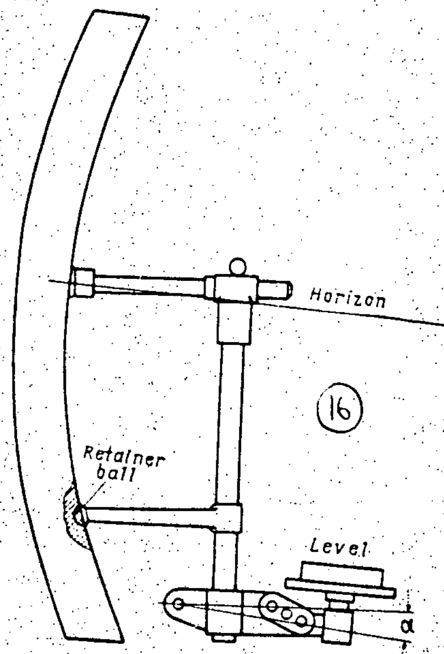
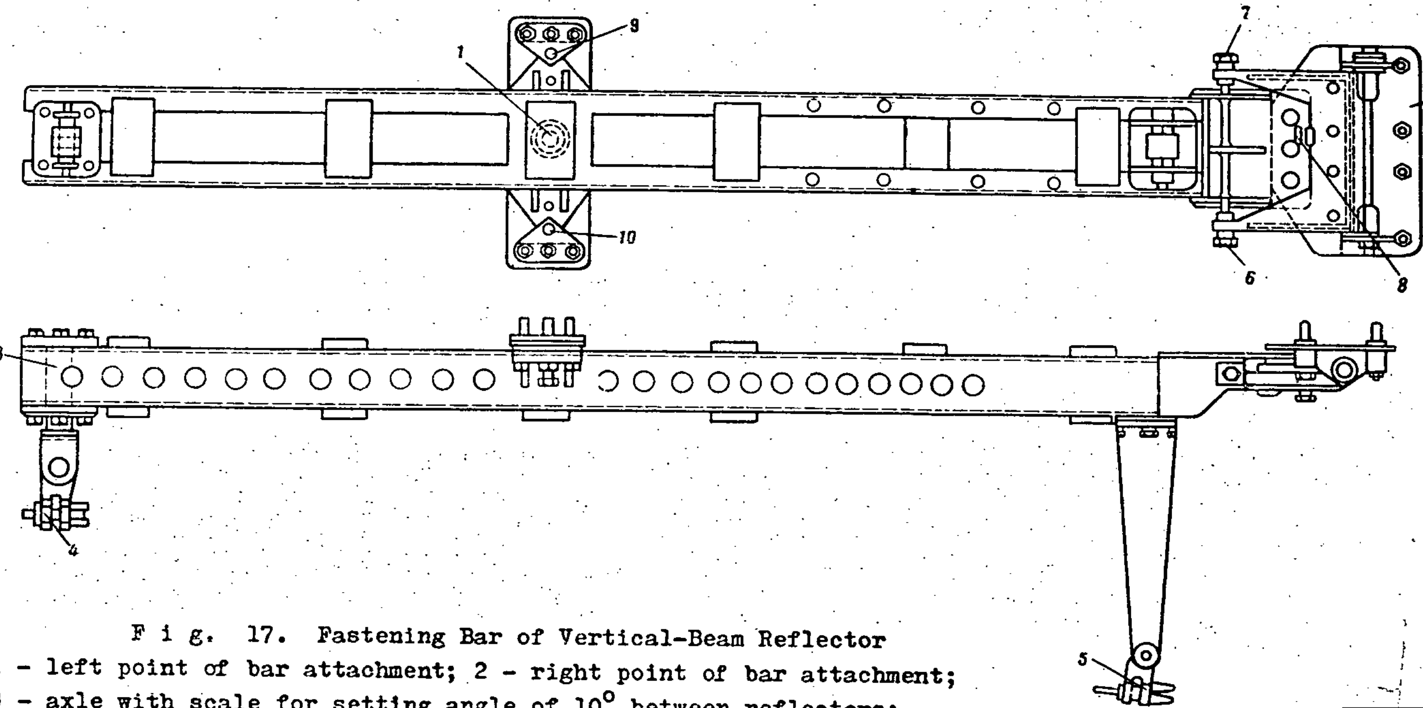
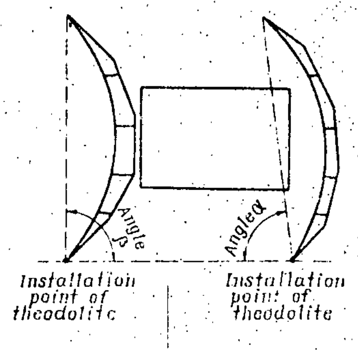


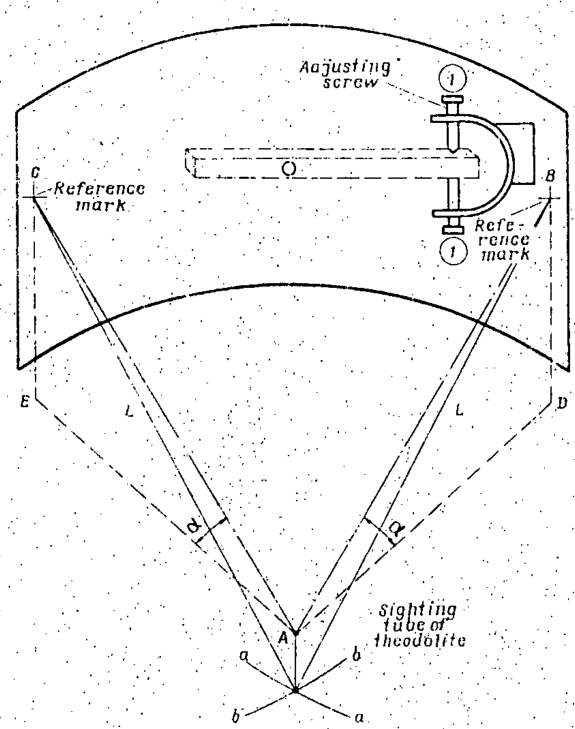
Fig. 16. Installation of Reflector Adjuster



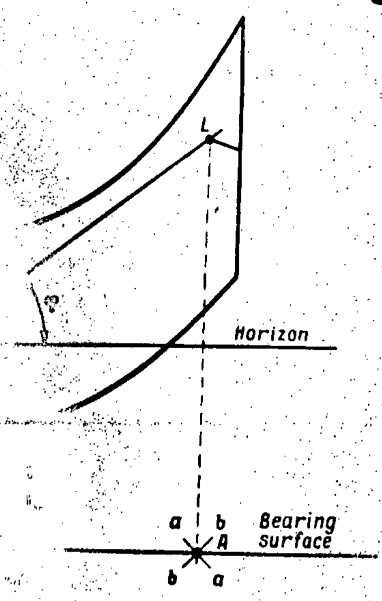
F i g. 17. Fastening Bar of Vertical-Beam Reflector
1 - left point of bar attachment; 2 - right point of bar attachment; 3 - axle with scale for setting angle of 10° between reflectors; 4 - left point of attachment of reflector to bar; 5 - right point of attachment of reflector to bar; 6 and 7 - adjusting bolts; 8 - vertical reflector scale; 9 - 10 - locking bolts.



F i g. 19. Setting of Lead Angle of Vertical-Beam Reflector (10°)



F i g. 20. Levelling of Vertical-Beam Reflector



[illegible] 21. Setting of [illegible]gitudinal Axis of [illegible]-Beam Reflector at Angle of 45° Relative to Horizon

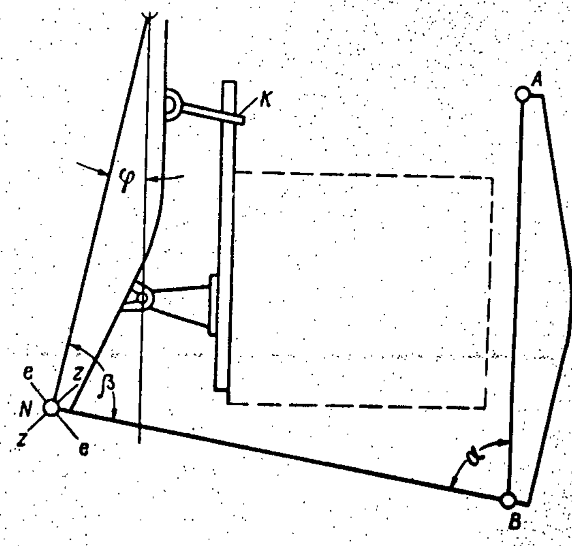


Fig. 22. Check of Relative Angle Between Reflectors

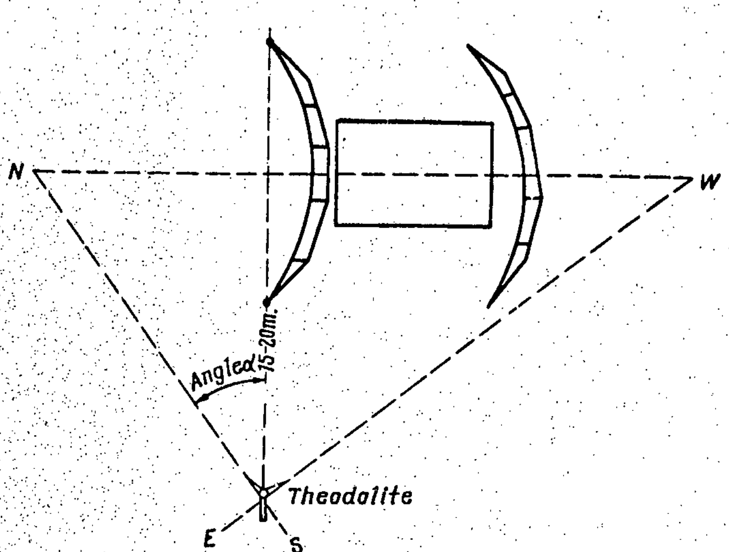
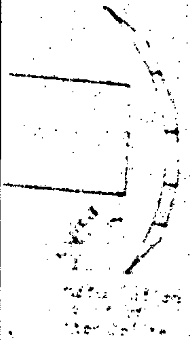
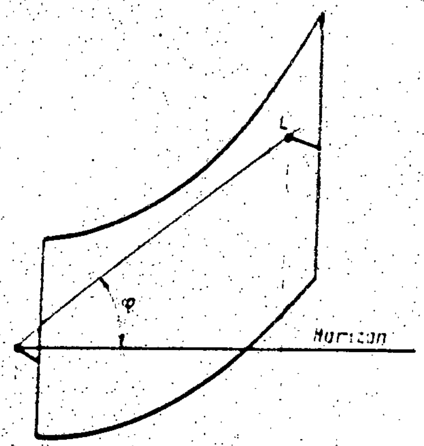


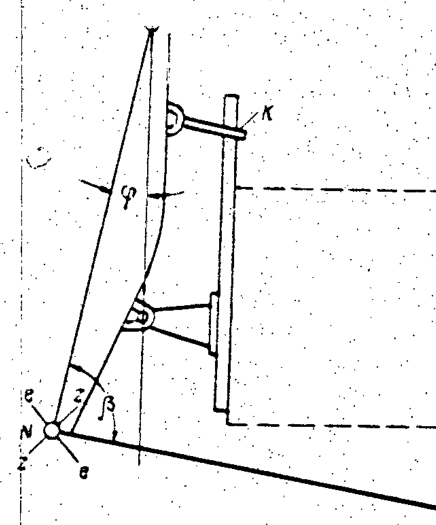
Fig. 23. Orientation of Antenna Relative to Meridian



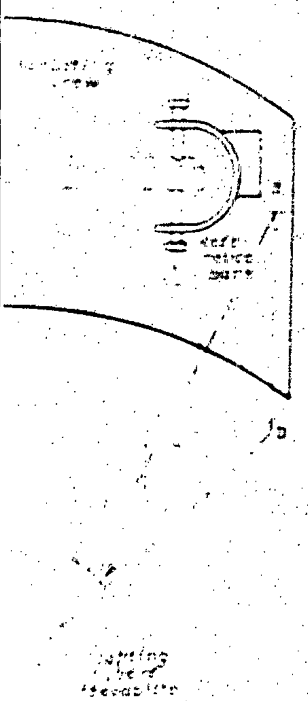
...ting of Lead
...tical-Beam
...r (10°)



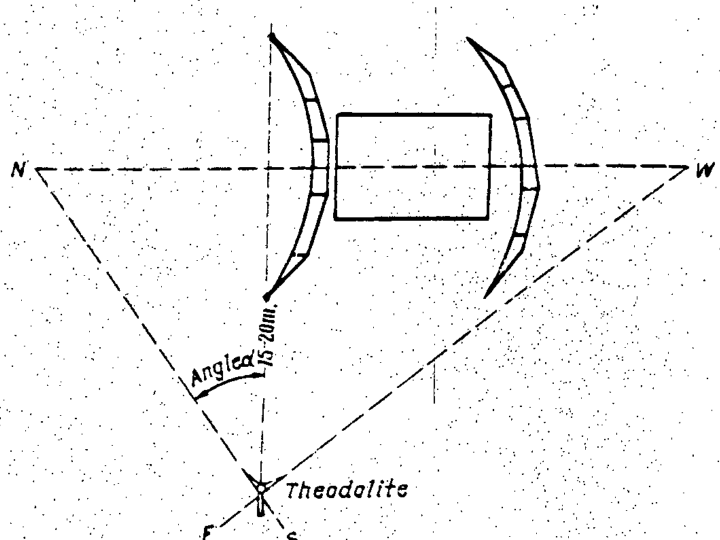
F i g. 21. Setting of Longitudinal Axis of Slant-Beam Reflector at Angle of 45° Relative to Horizon



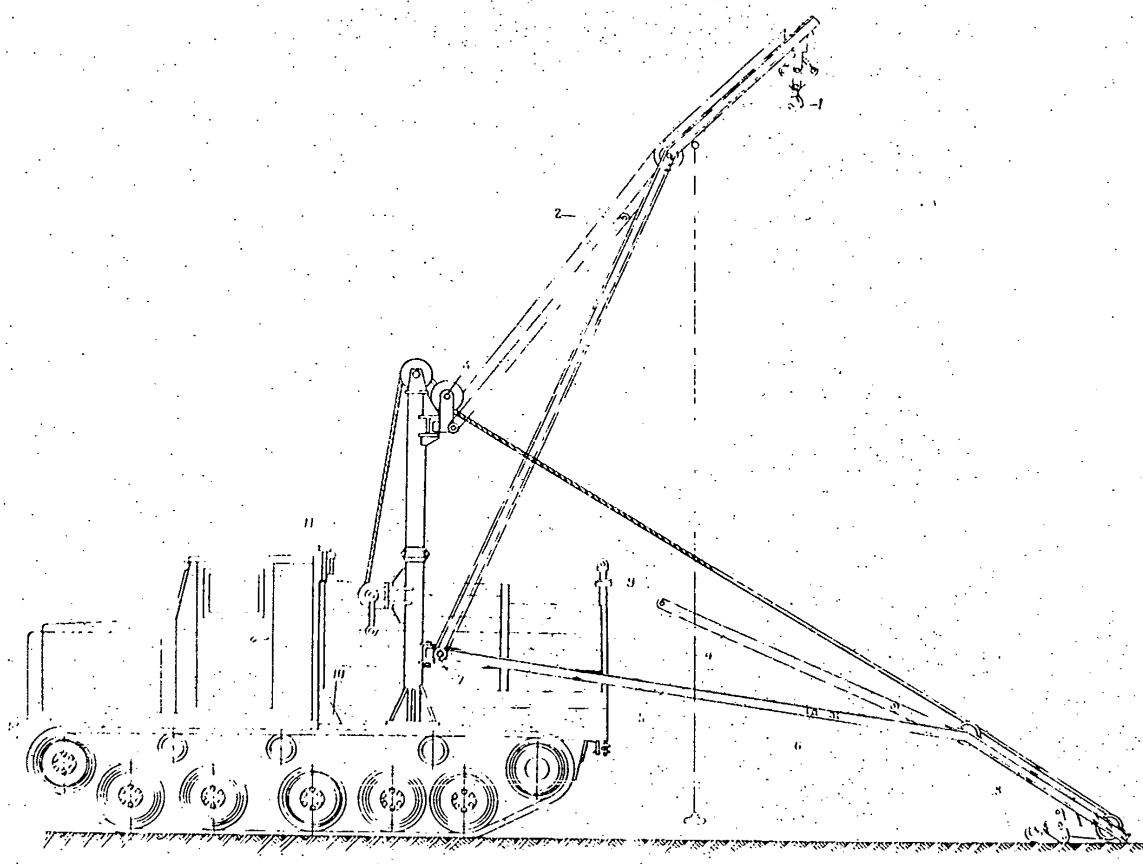
F i g. 22. Check of Relat... Angle Between Reflectors...



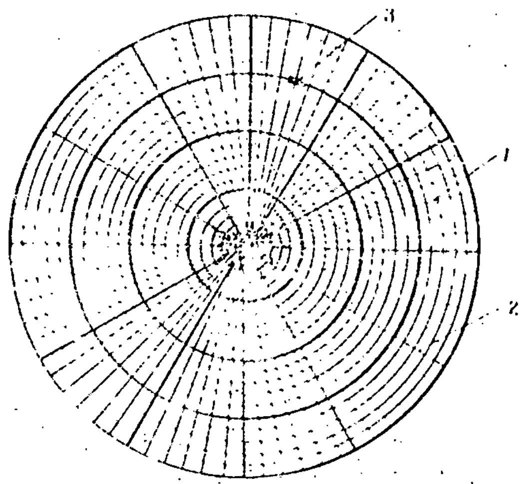
...ng of Vertical-Beam
...tor



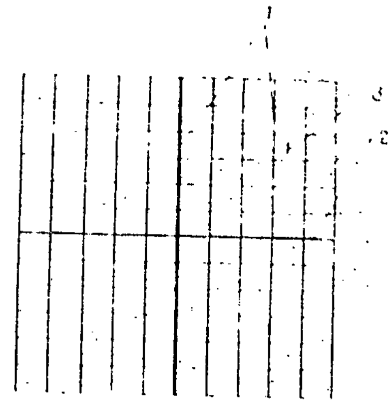
F i g. 23. Orientation of Antenna Relative to Meridian



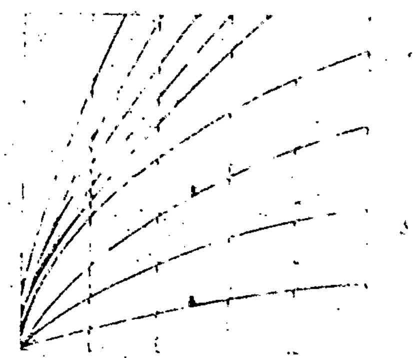
F i g. 24. Dismantling of Crane
1 - hook; 2 - locking pin; 3 - hinge pin; 4 - brace bar; 5 - jib lower section; 6 - fastening of jib lower section; 7 - lower rest; 8 - jib upper section; 9 - rear support; 10 - kneeplate; 11 - front support (mast)



F i g. 26. Plan Position Indicator Screen (Range 200 km)
1 – range markers;
2 – azimuth markers;
3 – target marker.



F i g. 27. Range and Azimuth Indicator Screen (Range 100 km)
1 – range markers;
2 – azimuth markers; 3 – target markers.



F i g. 28. Height Indicator Screen
1 – range marker;
2 – elevation marker;
3 – vertical – beam target marker

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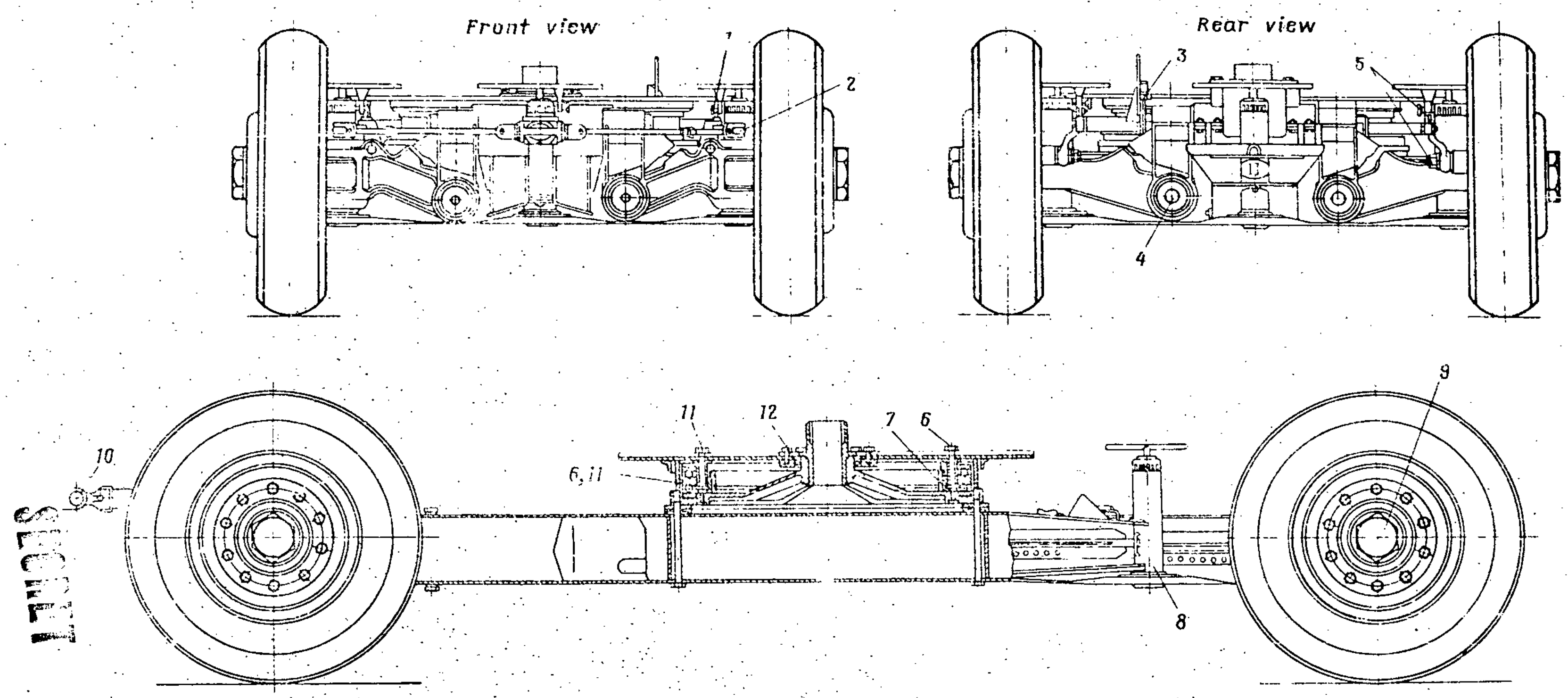

F i g. 30. Lubrication Chart of Carriage

1 – lubrication point of front wheel locks; 2 – lubrication point of pins of transverse steering rods; 3 – lubrication point of brake toothed sector; 4 – lubrication point of brakes; 5 – lubrication point of brake levers; 6 – lubrication hole of race ring bearing; 7 – gear lubrication point; 8 – lubrication point of jack screw; 9 – wheel bearing lubrication point; 10 – hinge lubrication point of tie rod; 11 – oil cup for race ring bearing; 12 – oil cup for centering bearing.

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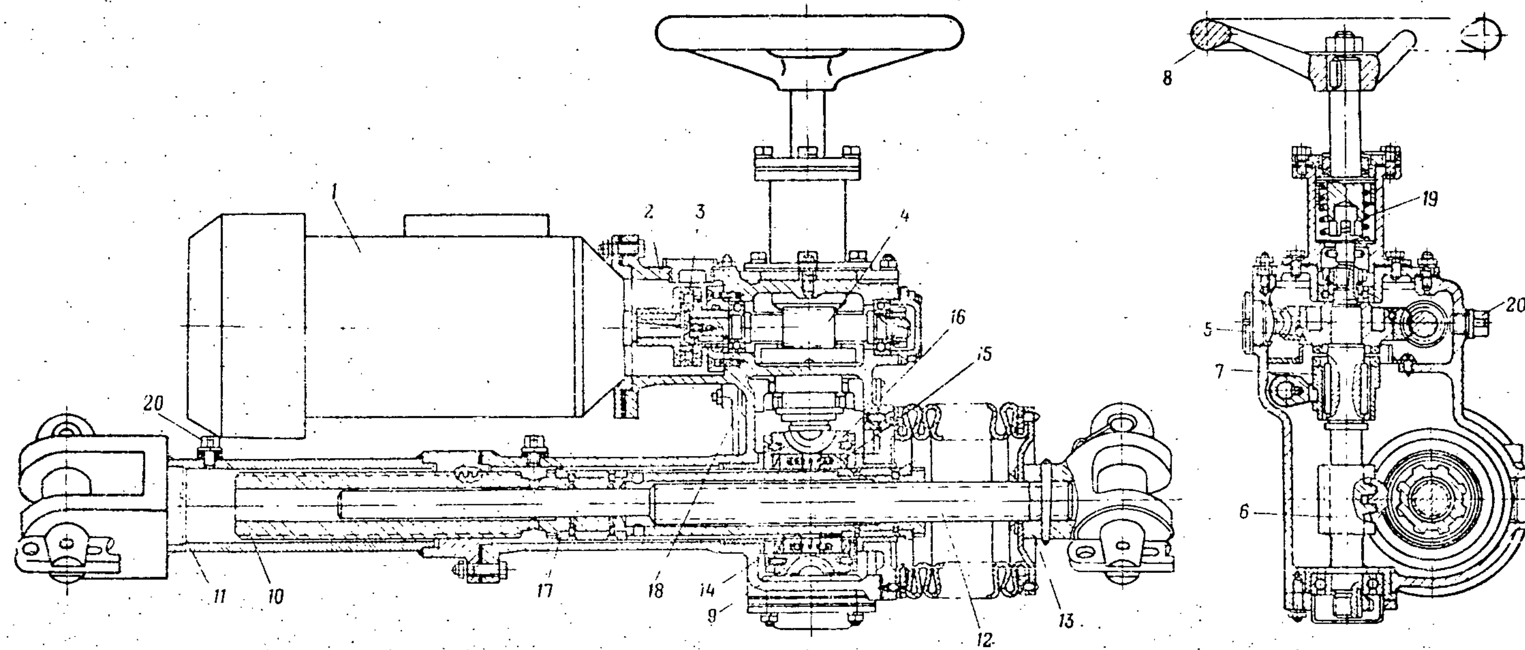
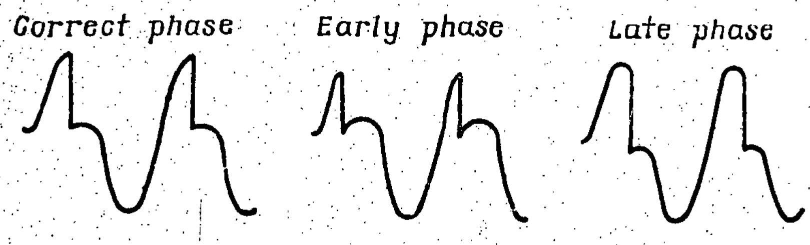
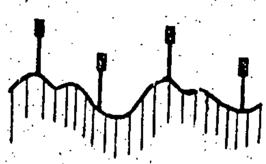


F i g. 32. Swinging Mechanism

1 - electric motor; 2 - reduction unit case; 3 - elastic clutch; 4 - smaller worm; 5 - worm gear; 6 - bigger worm; 7 - cam clutch; 8 - handwheel; 9 - worm gear; 10 - quill shaft; 11 - cup; 12 - central screw; 13 - lug; 14 - side cover; 15 - ratchet; 16 - spring; 17 - disengaging stop; 18 - shifting handle; 19 - spring; 20 - oil plug.

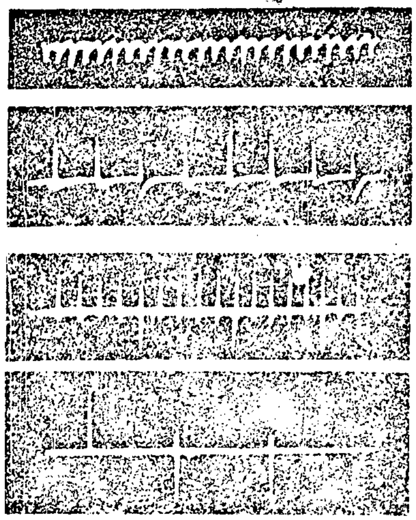


F i g. 33. Oscillogram of Discharge Phase

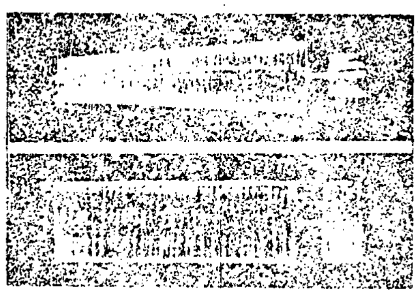


F i g. 34

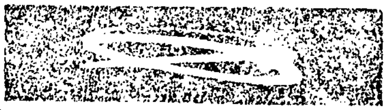
F i g. 35. Check of Automatic Frequency Control Channel for Proper Functioning



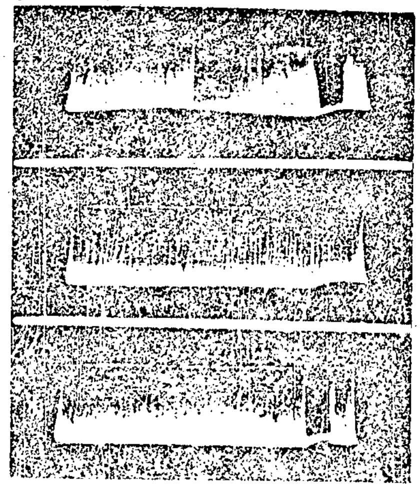
F i g. 36. Calibrator Oscillograms
(a) first frequency division;
(b) second frequency division;
(c) third frequency division;
(d) fourth frequency division.



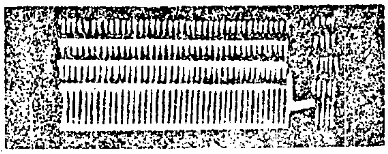
F i g. 37. Presentation of Shock-Excited Circuit Sine Curve (low-speed sweep)
(a) incorrect presentation;
(b) correct presentation.



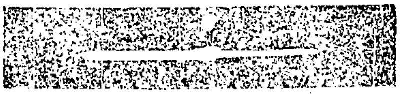
F i g. 38. Presentation of Shock-Excited Sine Curve at Sine Sweep



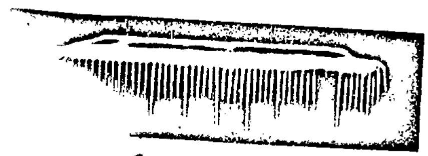
F i g. 39. Presentation of Shock- Excited Circuit Sine Curve at Different Adjustment Positions of Lock-out Pulse
a) and; (b) incorrect presentation; (c) correct presentation



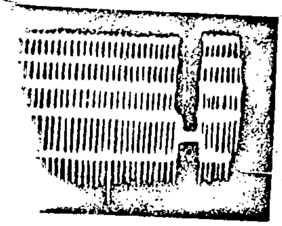
F i g. 40. Voltage Oscillogram on Storage Capacitor (low-speed sweep)



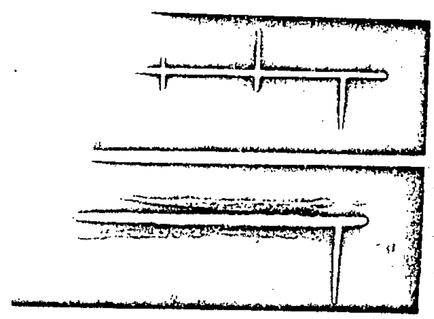
F i g. 41. Presentation of Lock-out Pulse (sine sweep)



5. Presentation of
nd 100 km. Markers
peed sweep)



. Display on
aph At Normal
ng of Range
ker Unit



F i g. 48. Presentation of Calibrator Fourth Division Pulse and Trigger Pulse
(a) fourth division of calibrator; (b) trigger pulse.

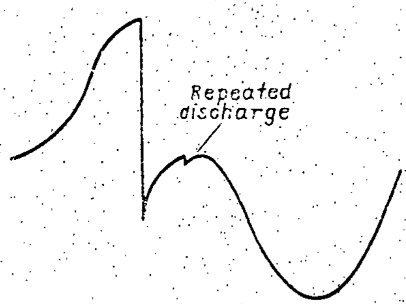
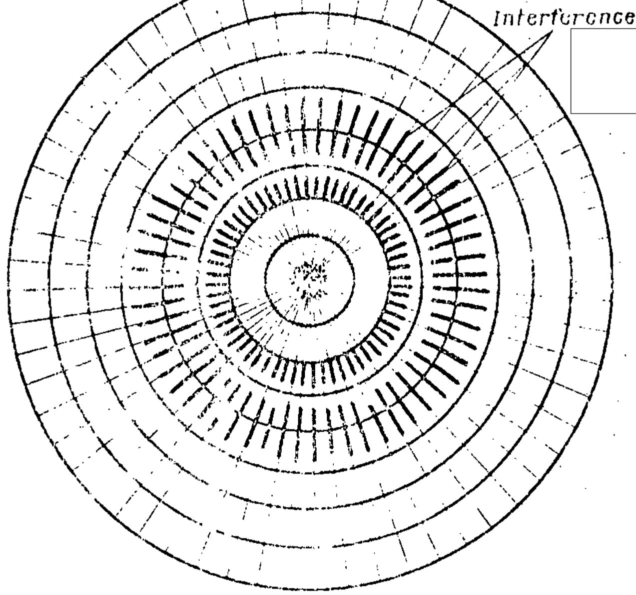
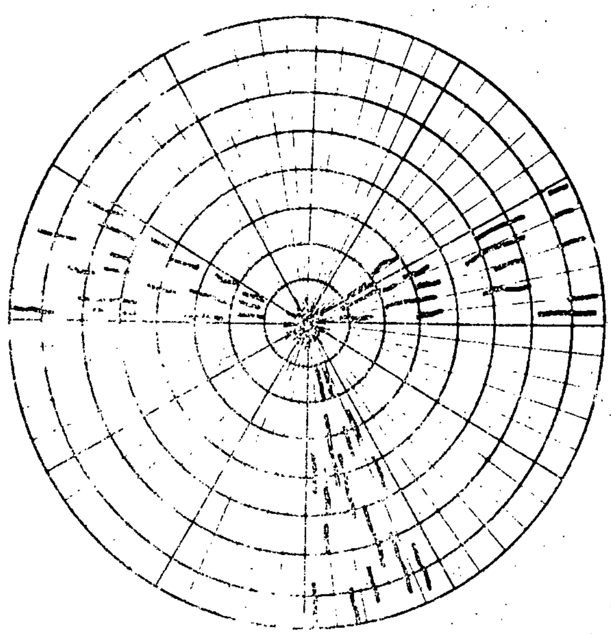


Fig. 49. Discharge Phase Curve on Oscillograph Screen During Repeated Discharge



F i g. 52. Interference Display on Plan Position Indicator Due to Poor Bedding of Brushes of Set, Type ВПЛ-12



F i g. 53. Interference Display on Plan Position Indicator Screen Due to Poor Contact of Brushes of Rotary Joint

ALBUM
OF WIRING DIAGRAMS

PART II

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RADAR STATION П-20

ALBUM
OF WIRING DIAGRAMS

PART II

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C O N T E N T S

List of Diagrams

List of Tables to Diagrams

SYMBOLS

USED IN ALBUM

SYMBOLS

АП-А,В,Г,Д,Е – antenna switch
АЛД-60 – power unit
БК-01 – receiver supply unit
БП-01 – indicator supply unit
БП-02 – supply unit of marker unit and control cabinet
ВО-01 – azimuth-range indicator
ВПЛ-12 – motor-generator set
ГА-01 – 1500 c.p.s. generator
ДА-01 – range marker unit
ЕЭ-02 – echo-signal receiver
ЖА-50 – azimuth marker unit
ЗА-01 – antenna turn angle marker unit
ИВ-01 – antenna rotation simulator
ИР-02 – spark gap
МК-02 – vertical-beam reflector swinging mechanism
МК-03 – slant-beam reflector swinging mechanism
МН-02 – keyer
НО-02 – height indicator
НРЗ-1 – interrogator-responsor
ПК-02 – vertical-beam antenna adapter box
ПК-03 – slant-beam antenna adapter box
ПО-02 – P.P.I.
ПО-03 – P.P.I. repeater
ПУ-02 – control panel
ПУ-03 – control panel
РЩ-02 – distributing board
СБ-50 – mixer unit
СД-02 – selsyn of slant-beam reflector swinging unit
СД-03 – selsyn of vertical-beam reflector swinging unit
СЛ-262 /$Я_1$/ – motor (armature$_1$)
СЛ-262 /$Я_2$/ – motor (armature$_2$)
ССП – rotation servo system
ТК-02 – rotary joint with slip rings
ТП-02 – telephone panel of indicators ПО-02 and ВО-01
ТП-03 – telephone panel of cabinet НО-02 (height indicator)
ТУ-02 – telephone panel of control cabinet
УС-02 – servo amplifier
ФД-01 – main transmitting selsyn unit
ХА-01 – selsyn repeater
ЦР – centrifugal relay
ЦУ-02 – central control panel
ША-02 – R-F unit cabinet (receiver-transmitter)
ШУ-01 – local control cabinet
ШУ-02 – receiver-transmitter local control cabinet
ШУ-50 – local control cabinet
ШУП-242 – control panel
ЯП-01 – ignition voltage rectifier

WIRE TABLE TO R-F CONNECTION DIAGRAM OF TRUCK No.2
(Fig.2)

No. of cable	Runs from/to	Purpose of circuit
021	Connector 1097 of unit ДА-01 Cable box connector 1101	Triggering
023	Connector 1321 of unit СБ-50 Connector 1075 of unit ЖА-50	Triggering
024	Connector 1013 of unit ПО-02 Connector 1322 of unit СБ-50	Triggering
025	Connector 1032 of unit ВО-01 Connector 1014 of unit ПО-02	Triggering
026	Connector 1041 of unit ЗА-01 Connector 1033 of unit ВО-01	Triggering
027	Cable box connector 1108 Connector 1083 of unit НО-02	Triggering
028	Cable box connector 1102 Connector 1323 of unit СБ-50	Input of upper vertical video channel
029	Cable box connector 1103 Connector 1324 of unit СБ-50	Input of middle vertical video channel
030	Cable box connector 1104 Connector 1325 of unit СБ-50	Input of lower vertical video channel
031	Cable box connector 1105	Input of upper slant video channel

1	2	3
	Connector 1326 of unit СБ-50	
032	Cable box connector 1106	Input of lower slant video channel
	Connector 1328 of unit СБ-50	
033	Connector 1005 of unit ПО-02	Output of vertical video channel
	Connector 1330 of unit СБ-50	
034	Connector 1024 of unit ВО-01	of vertical video channel
	Connector 1006 of unit ПО-02	
035	Connector 1080 of unit НО-02	Same
	Connector 1025 of unit ВО-01	
036	Cable box connector 1109	Same
	Connector 1081 of unit НО-02	
037	Connector 1545 of unit ПО-02	Output of slant video channel
	Connector 1329 of unit СБ-50	
038	Connector 1545 of unit ВО-01	Same
	Connector 1546 of unit ПО-02	
039	Connector 1045 of unit НО-02	Same
	Connector 1546 of unit ВО-01	
040	Cable box connector 1110	Output of slant video channel
	Connector 1046 of unit НО-01	
041	Cable box connector 1107	Identification
	Connector 1109 of unit ПО-02	
042	Connector 1028 of unit ВО-01	Same
	Connector 1010 of unit ПО-02	
043	Connector 1029 of unit ВО-01	Same
	Cable box connector 1111	
044	Connector 1007 of unit ПО-02	Range markers
	Connector 1095 of unit ДА-01	
045	Connector 1026 of unit ВО-01	Same
	Connector 1008 of unit ПО-02	
046	Connector 1047 of unit НО-02	Same
	Connector 1027 of unit ВО-01	

1	2	3
047	Connector 1077 of unit HO-02 Cable box connector 1112	Range markers
048	Connector 1073 of unit ЖА-50 Connector 1011 of unit ПО-02	Azimuth markers
049	Connector 1012 of unit ПО-02	Same
	Connector 1030 of unit BO-01	
050	Connector 1031 of unit BO-01 Connector 1078 of unit HO-02	Azimuth markers
051	Cable box connector Connector 1079 of unit HO-02	Same

WIRE TABLE TO CONNECTION DIAGRAM OF TRUCK No.2
(Figs 1, 3 and 4)

No. of cable Runs from/to	No. of cores	Purpose of cores
01	210	Telephone of indicator ПО-02
Distributing board	211	Same
block 1146	225	220 V phase a
Connector 1021 of	226	220 V, phase b
unit БП-01	227	220 V, phase c
	0	Earth
02	212	Telephone of indicator ВО-01
Distributing board	213	Same
block 1147/1146	225	220 V, phase a
Connector 1021 of	226	220 V, phase b
unit БП-01	227	220 V, phase c
	0	Earth
03	214	Telephone of indicator НО-02
Distributing board	215	Same
block 1145	225	220 V, phase a
Connector 1021 of	226	220 V, phase b
unit БП-01	227	220 V, phase c
	0	Earth
04	225	220 V, phase a
Distributing board	226	220 V, phase b
block 1145	227	220 V, phase c
Connector 1021 of	0	Earth
unit БП-02		
05	225	220 V, phase a

1	2	3
Distributing board block 1146 Connector 1021 of unit БП–02	226	220 V, phase b
	227	220 V, phase c
	0	Earth
06 Distributing board block 1151 Connector 1016 of unit ПО–02	37	Fine tracking selsyn, 50 c.p.s.
	38	Same
	39	Same
	40	Coarse tracking selsyn, 50 c.p.s.
	41	Same
	161	Same
	26	Identification transmitter, switching on
07 Distributing board block 1150 Connector 1034 of unit BO–01	26	Identification transmitter, switching on
	205	Transmitting selsyn of unit XA–01
	206	Same
	207	Same
	208	Unit ЖА–50, voltage 1500 c.p.s.
	209	Same
08 Distributing board block 1150 Connector 1085 of unit HO–02	33	Fine selsyn, 1500 c.p.s.
	34	Same
	35	Same
	205	Transmitting selsyn of unit XA–01
	206	Same
	207	Same

1	2		3
	208		Unit ЖА–50, voltage 1500 c.p.s.
	209		Same
09 Distributing board block 1149 Connector 1331 of unit СБ–50	7 No.1	I.A.G.C. relay	Lower vertical
	7 No.2		Middle vertical
	7 No.3		Upper vertical
	7 No.4		Lower slant
	7 No.5		Upper slant
	13 No.5		Differential relay, upper slant
010 Distributing board block 1152 Connector 1333 of unit СБ–50	19 No.1	Gain control	Lower vertical
	19 No.2		Middle vertical
	19 No.3		Upper vertical
	19 No.4		Lower slant
	19 No.5		Upper slant
	19 No.6		Identification receiver
	13 No.1	Differential relay	Lower vertical
	13 No.2		Middle vertical
	13 No.3		Upper vertical
	13 No.4		Lower slant
011 Distributing board block 1153 Connector 1088 of unit ЦУ–02	27		UNIT FAILURE signalling
	28		COMPLETE FAILURE signalling
	29		READY signalling
	30		INTERLOCK signalling
	42		Cabin turning motor, 3 r.p.m., switching on
	46		Cabin turning motor, 6 r.p.m., switching on

1	2	3
	47	Warning signal, switching on
	48	Transmitter-receiver equipment, switching on
	31	Blower connection signalling
	32	ON signalling
	223	Truck body lighting, 12 V, 50 c.p.s.
	224	Same
012 Distributing board block 1148 Connector 1099 of unit ЦУ-02	53 No.1	Measurement of magnetron currents of R-F units ША-02
	53 No.2	Same
	53 No.3	Same
	53 No.4	Same
	53 No.5	Same
	218	220 V, phase a
	219	220 V, phase b
	220	220 V, phase c
	225	220 V, phase a
	226	220 V, phase b
	227	220 V, phase c
	0	Earth
014 Distributing board block 1151 Connector 1089 of unit XA-01	37	Fine tracking selsyn, 50 c.p.s.
	38	Same
	39	Same

1	2	3
	40	Coarse tracking selsyn, 50 c.p.s.
	41	Same
	161	Same
015 Distributing board block 1150 Connector 1090 of unit XA-01	33	Fine selsyn, 1500 c.p.s.
	34	Same
	35	Same
	205	Transmitting selsyn of unit XA-01
	206	Same
	207	Same
	208	Unit ЖА-50, voltage 1500 c.p.s.
	209	Same
016 Distributing board block 1148 Control board block 1208	218	220 V, 50 c.p.s., phase a
	219	220 V, 50 c.p.s., phase b
	220	220 V, 50 c.p.s., phase c
017 Distributing board block 1149 Control board block 1208	223	Truck body lighting, 12 V, 50 c.p.s.
	224	Same
018 Battery control board blocks 1208	221	Emergency truck body lighting, 12 V
	222	Same
019 Block 1155	210	Telephone of indicator ПО-02

1	2	3
Distributing board block 1149	211	Telephone of indicator ПО-02
Block 1565	244	Telephone line
	245	Same
	246	Same
	247	Same
	248	Same
	249	Same
	250	Same
	251	Same
	252	Telephone of control cabinet
	253	Same
	254	Control exchange telephone
	255	Same
020	216	Power plant telephone
Block 1149	217	Same
Distributing board block 1150	223	Switchboard lighting, 12 V, 50 c.p.s.
Block 1565	224	Same
—	240 No.1	Stand-by telephone line
	241 No.1	Same
	241 No.2	Telephone of indicator ПО-03
	0	Same
022	33	Fine selsyn, 1500 c.p.s.

1	2	3
Distributing board block 1151	34	Fine selsyn, 1500 c.p.s.
	35	Same
Connector 1335 of unit ИВ-01	37	Fine tracking selsyn, 50 c.p.s.
	38	Same
	39	Same
	40	Coarse tracking selsyn, 5(c.p.s.
	41	Same
	161	Same
	225	220 V, 50 c.p.s., phase a
	226	220 V, 50 c.p.s., phase b
	227	220 V, 50 c.p.s., phase c
023	93	Antenna swinging DOWN
Block 1152	94	Antenna swinging UP
Block 1151	95	Rotor of swinging receiving selsyn
Distributing board block 1156	96	Same
Block 1564 of panel ТУ-02	225	220 V, 50 c.p.s., phase a
	226	220 V, 50 c.p.s., phase b
	0	Earth
024	110	Rotor of swinging receiving selsyn
board block 1147	111	Same
Block 1551 of panel ТП-08	112	Antenna swinging UP
	113	Antenna swinging DOWN
	225	220 V, 50 c.p.s., phase a
	226	220 V, 50 c.p.s., phase b
	0	Earth

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1	2	3
052 Distributing board block 1154 Block 1562 Block 1563 of panel ТУ-02	210	Telephone of indicator ПО-02
	211	Same
	212	Telephone of indicator ВО-01
	213	Same
	214	Telephone of indicator НО-02
	215	Same
	242	Telephone of command post
	243	Same
	252	Telephone of control cabinet
	253	Same
055 Distributing board block 1145 Connector 1144 of cable box	225	220 V, phase a
	225	Same
	226	220 V, phase b
	226	Same
	227	220 V, phase c
	227	Same
056 Distributing board block 1147 Connector 1116 of cable box	96	Rotor of swinging receiving selsyn
	110	Same
	111	Same
	112	Antenna swinging UP
	113	Antenna swinging DOWN

1	2	3
057 Block 1148 Distributing board block 1149 Connector 1116 of cable box	7 No.1	I.A.G.C. relay: Lower vertical
	7 No.2	Middle vertical
	7 No.3	Upper vertical
	7 No.4	Lower slant
	7 No.5	Upper slant
	53 No.1	Measurement of magnetron currents of R-F units ША-02
	53 No.2	Same
	53 No.3	Same
	53 No.4	Same
	53 No.5	Same
	13 No.5	Differential relay, upper slant
058 Distributing board block 1154 Cable box terminal block	210	Telephone of indicator ПО-02
	211	Same
	212	Telephone of indicator ВО-01
	213	Same
	214	Telephone of indicator НО-02
	215	Same
	242	Telephone of command post
	243	Same
059 Distributing board block 1155	244	Telephone line
	245	Same
	246	Same

1	2	3
Cable box terminal block	247	Telephone line
	248	Same
	249	Same
	250	Same
	251	Same
	254	Central exchange telephone
	255	Same
060 Distributing board block 1150 Cable box connector 1119	205	Transmitting selsyn of unit XA-01
	206	Same
	207	Same
	208	Unit ЖА-50, voltage 1500 c.p.s.
	209	Same
	216	Telephone of power plant
	217	Same
	240 No.1	Stand-by telephone line
	241 No.1	Same
061 Block 1151 Distributing board block 1149 Cable box connector 1118	37	Fine tracking selsyn, 50 c.p.s.
	38	Same
	39	Same
	40	Coarse tracking selsyn, 50 c.p.s.
	41	Same
	161	Same

1	2	3
	241 No.2	Telephone of indicator ПО-03
	0	Same
	26	Identification transmitter, switching on
062 Distributing board block 1152 Cable box connector 1115	11	Interrogation
	16	Remote control of identification transmitter tuning
	13 No.1	Differential relay: Lower vertical
	13 No.2	Middle vertical
	13 No.3	Upper vertical
	13 No.4	Lower slant
	19 No.1	Gain control: Lower vertical
	19 No.2	Middle vertical
	19 No.3	Upper vertical
	19 No.4	Lower slant
	19 No.5	Upper slant
	19 No.6	Identification receiver
063 Blocks 1569 Switchboard block	210	Telephone of indicator ПО-02
	211	Same
	216	Telephone of power plant
	217	Same
	240 No.1	Stand-by telephone line
	241 No.1	Same
	241 No.2	Telephone of unit ПО-03

1	2	3
	244	Telephone line
	245	Same
	246	Same
	247	Same
	248	Same
	249	Same
	250	Same
	251	Same
	252	Telephone of control cabinet
	253	Same
	0	Earth
064	25	Identification transmitter, switching on
Distributing board block 1153	27	UNIT FAILURE signalling
Cable box connector 1114	28	COMPLETE FAILURE signalling
	29	Same
	30	INTERLOCK signalling
	31	Blower connection signalling
	32	ON signalling
	42	Cabin turning motor, 3 r.p.m., switching on
	46	Cabin turning motor, 6 r.p.m., switching on
	47	Warning signal, switching on
	48	Transmitter-receiver equipment, switching on

1	2	3
065	222	Emergency truck body lighting, 12 V
Control board block 1209		
Dome light No.1	228	Same
/		
066	231	Truck body lighting, 12 V, 50 c.p.s.
Control board block 1209		
Dome light No.2	232	Same
067	233	Fan ЭM-2, power supply
Control board block 1209	234	Same
Block 1210	235	Same
068	236	Fan ЭM-1, power supply
Control board block 1209	237	Same
Block 1211	238	Same
069	33	Fine selsyn, 1500 c.p.s.
Distributing board	34	Same
block 1157	35	Same
Connector 1634 of unit ИВ-01	161	Coarse tracking selsyn, 50 c.p.s.
	40	Same
	41	Same
	39	Fine tracking selsyn, 50 c.p.s.
	37	Same
	38	Same

1	2	3
070	231	Truck body lighting, 12 V, 50 c.p.s.
Control board block 1209		
Dome light No.3	232	Same
072	33	Fine selsyn, 1500 c.p.s.
Distributing board	34	Same
block 1156/1157	35	Same
Cable box connector 1117	37	Fine tracking selsyn, 50 c.p.s.

1	2	3
	38	Fine tracking selsyn, 50 c.p.s.
	39	Same
	40	Coarse tracking selsyn, 50 c.p.s.
	41	Same
	161	Same
	93	Antenna swinging DOWN
	94	Antenna swinging UP
	96	Rotor of swinging receiving selsyn

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WIRE TABLE TO CONNECTION DIAGRAM OF CABINETS
(Fig.6)

No. of cable Runs from/to	No. of cores	Purpose of cores
1	2	3
H-01		Anode high voltage, +5.5
Connector 1018 of unit БП-01		Same
Connector 1044 of unit НО-02		Same
H-02	236	Valve heater voltage, 6.3 A.C.
Terminals 1067 and 1068 of unit БП-01	237	Same
Terminals 1087 and 1088 of unit НО-02		
H-03	261	-150 V
Connector 1020 of unit БП-01	264	Valve heater voltage, 6.3 V A.C.
Connector 1086 of unit НО-02	265	Same
	266	Same
	267	Valve heater voltage, 6.3 V A.C.
	268	Same
	269	Same
	0	Earth
	272	+300 V
H-04	214	Telephone of unit
	215	Same
unit БП-01	226	Interlock
Cabinet block 1104	239	Same
H-05	261	-150 V
Connector 1084 of unit НО-02	262	Valve heater voltage, 6.3 V A.C.
Connector 1043 of	263	Same
unit ЗА-01	278	Cathode follower, selsyn-transformer

1	2	3
	279	Cathode follower, selsyn-transformer
	0	Earth
	272	+300 V
Н-06		
Connector 1082 of unit НО-02		Triggering
Connector 1042 of unit ЗА-01		
Н-07		
Connector 1222 of unit ЗА-01		Antenna turn angle markers
Connector 1223 of unit НО-02		
В-01		
Connector 1018 of unit БП-01		Anode high voltage, +5.5 kV
Connector 1023 of unit ВО-01		
В-02		
Terminals 1067 and 1068 of unit БП-01	236	Valve heater voltage, 6.3 V 20 A A.C.
Terminals 1048/1049	237	Same
В-03		
Connector 1020 of unit БП-01	261	-150 V
	262	Valve heater voltage, 6.3 V A.C.

1	2	3
Connector 1035 of unit ВО-01	263	Valve heater voltage, 6.3 V A.C.
	264	Same
	265	Same
	266	Same
	267	Same
	268	Same
	269	Same
	0	Earth
	272	+300 V
В-04		
Connector 1022 of unit БП-01	212	Telephone of unit ВО-01
	213	Same
	226	Interlock
Cabinet block 1104	239	Same
П-01		
Connector 1018 of unit БП-01		Anode high voltage, +5.5 kV
Connector 1004 of unit ПО-02		
П-02		
Terminals 1067 and 1068 of unit БП-01		Valve heater voltage, 6.3 V A
Terminals 1050 and 1051 of unit ПО-02	237	Same
П-03		
Connector 1020 of unit БП-01	261	-150 V
	262	Valve heater voltage, 6.3 V A.C.

1	2	3
Connector 1017 of unit ПО-02	263	Valve heater voltage, 6.3 V A.C.
	264	Same
	265	Same
	268	Same
	269	Same
	270	220 V, phase 3 after heater voltage circuit breaker
	0	Earth
	271	220 V, phase 5 after heater voltage circuit breaker
	272	+300 V
П-04		
Connector 1022 of unit БП-01	210	Telephone of unit ПО-02
	211	Same
	226	Interlock
Cabinet block 1104	239	Same
П-05		
Connector 1015 of unit ПО-02	256	Input of coarse reading channel
	257	Same
Connector 1003 of unit УС-02	258	Input of fine reading channel
	259	Same
	273	To armature СЛ-262(Я$_1$) of unit ПО-02
	274	Output of servo amplifier
	0	Earth
	275	To armature СЛ-262(Я$_2$) of unit ПО-02
	270	220 V, phase 3 after heater voltage circuit breaker
	0	Earth
	271	220 V, phase 5 after heater voltage circuit breaker
Ц-01		
Terminals 1067/1068 of unit БП-02	236	Valve heater voltage, 6.3 V A.C.
Terminals 1335/1334 of unit СБ-50	237	Same
Ц-02		
Connector 1019 of unit БП-02	261	-150 V
	262	Valve heater voltage, 6.3 V A.C.
Connector 1332 of unit СБ-50	263	Same
	279	Interlock
	281	Same
	0	Earth
	272	+300 V
Х-01		
Terminals 1067/1068 of unit БП-02	236	Valve heater voltage, 6.3 V 20 A A.C.
Terminals 1092/1093 of unit ДА-01	237	Same
[illegible]-02	261	-150 V

1	2	3
Connector 1019 of unit БП-02 Connector 1094 of unit ДА-01	278	220 V, phase 3 after heater voltage circuit breaker
	279	Interlock
	280	220 V, phase 5 after heater voltage circuit breaker
	281	Interlock
	270	220 V, phase 3 after heater voltage circuit breaker
	0	Earth
	271	220 V, phase 5 after heater voltage circuit, breaker
	272	+300 V
ХА-03 Connector 1020 of unit БП-02 Connector 1076 of unit ЖА-50	261	-150 V
	262	Valve heater voltage 6.3 V A.C.
	263	Same
	264	Same
	265	Same
	266	Same
	267	Same
	268	Same
	269	Same
	270	220 V, phase 3 after heater voltage circuit breaker

1	2	3
	0	Earth
	271	220 V, phase 5 after heater voltage circuit breaker
	272	+300 V
X-05 Connector 1091 of unit ХА-01 Connector 1072 of unit ЖА-50	283	Output of cathode follower
	284	Same
	285	Rotor of 30° marker selsyn-transformer
	286	
	208	Voltage 1500 c.p.s. of unit ЖА-50
	209	Same
	270	220 V, phase 3 after heater voltage circuit breaker
	0	Earth
	271	220 V, phase 5 after heater voltage circuit breaker
	272	+300 V
X-06 Connector 1074 of unit ЖА-50 Connector 1096 of unit ДА-01		Triggering

WIRE TABLE TO CONNECTION DIAGRAM OF TRUCK No.3
(Figs 13, 14, 15 and 16)

No. of cable Runs from/to	No. of cores	Purpose of cores
1	2	3
01		
Adapter 1102	225	220 V, 50 c.p.s.
Truck connector box	226	222 V, 50 c.p.s.
	227	220 V, 50 c.p.s.
Connector 1432	0	Earth
Connector box of plan position indicator cabinet		
06	33	
Connector 1118	34	
Truck connector box	35	
Connector 1118	39	From 50 c.p.s. fine selsyn of unit ФД-01
Connector box of plan position indicator cabinet	37	6.3 V
	38	6.3 V
	161	From 50 c.p.s. coarse selsyn of unit ФД-01
	40	Same

No. of cable Runs from/to	No. of cores	Purpose of cores
1	2	3
	41	
	42	Telephone
	43	
	0	Telephone
016	225	220 V
Adapter 1102	226	220 V
Truck connector box	227	220 V
Unit ПУ-03		
Adapter 1105		
017	218	Fan power supply, 220 V
Unit ПУ-03	219	Same
Adapter 1105	220	Same
Adapter 1153 A		
018	223	Truck body lighting, 12 V
Unit ПУ-03	224	Same

1	2	3
Adapter 1105		
Dome lights		
019		Emergency truck light-
Starter battery/, switch		ing, 12 V
and dome light		
021	226	220 V
Adapter 1102	227	220 V
Truck connector box		
Receptacle on the truck front wall		
П-01		6 kV
Unit БП-01		
Connector 1018		
Unit ПО-03		
Connector 1004		
П-02		6.3 V
Unit БП-01, 1067, 1068		
Unit ПО-03, 1050, 1051		
П-03	261	-150 V
Unit БП-01	262	6.3 V
Connector 1020	263	6.3 V
Unit ПО-03	264	6.3 V
Connector 1017	265	6.3 V
	266	
	267	
	277	6.3 V
	276	6.3 V

1	2	3
	273	220 V, 50 c.p.s.
	0	Earth
	274	220 V, 50 c.p.s.
	275	300 V
	278	
П-04	226	Interlock
Unit БП-01	42	Telephone
Connector 1022	233	Interlock
Interlocking block 1104	0	Earth
П-04а	In series	Through all interlocking blocks
П-04б	42	Telephone
Interlocking block 1104	0	Earth
Telephone panel		
П-05	266	Coarse selsyn stator
Unit ПО-03	267	Same
Connector 1015	268	
Unit УС-02	269	
Connector 1003	273	
	274	
	270	
	271	
	272	
	225а	
	0	
	225в	
	275	
	276	

1	2	3
П-06 Connector box of cabinet ПО-03	161	From 50 c.p.s. coarse selsyn of unit ФД-01
	40	
Connector 1118	41	Same
Unit ПО-03	39	Same
Connector 1016	37	From 50 c.p.s. fine selsyn of unit ФД-01
	38	From 50 c.p.s. fine
	42	
	0	
П-07	225	220 V, 50 c.p.s.
Power unit, con-	42	Telephone
nector 1021	226	220 V, 50 c.p.s.
Connector box, ca-	0	Earth
binet ПО-03, con-	227	220 V, 50 c.p.s.
nector 1432	0	Earth
024 Connector box, cabinet ПО-03, connector 1108 Truck connector box, connector 1108		Triggering
033 Connector box, cabinet ПО-03, connector 1109 Truck connector box, connector 1109		Vertical echo signals

1	2	3
040 Connector box, cabinet ПО-03, connector 1111 Truck connector box, connector 1111		Identification
043 Connector box, cabinet ПО-03, connector 1112 Truck connector box, connector 1112		Range markers
047 Connector box, cabinet ПО-03, connector 1113 Truck connector box, connector 1113		Azimuth markers
041 Connector block, cabinet ПО-03, connector 1110 Truck connector box, connector 1110		Slant echo signals
К-028 Connector box, cabinet ПО-03, connector 1111 T-junction on interrogator cabinet, connector 1111		Triggering
К-027 Connector box, cabinet ПО-03, connector 152 T-junction on interrogator cabinet, connector 152,165		Identification

WIRE TABLE TO WIRING DIAGRAM OF PLAN POSITION INDICATOR
(Unit ПО-02)
(Figs 19 and 20)

No. of wire bundle	No. of wire	From			To			Type and cross-section of wire
		Part	Ref. No. in key diagram	No. of contact	Part	Ref. No. in key diagram	No. of contact	
1	2	3	4	5	6	7	8	9
	a-1	Terminal	1050,1051		Valve	26	2,7	МГВСЛ, 2 sq.mm
	a-2	Valve	26	2,7	Same	25	7,8	Same
	a-3	Same	25	7,8	Same	21	2,7	Same
	a-4	Same	21	2,7	Same	19	1,7	Same
	a-5	Same	19	2,7	Same	20	21,7	Same
	a-7	Terminal	1050,1051		Same	15	7,8	Same
	a-8	Valve	15	7,8	Same	16	2,7	Same
	a-9	Same	16	2,7	Same	17	2,7	Same
	a-10	Same	17	2,7	Same	18	7,8	Same
	a-11	Same	18	8	Block	6	7,8	МГВСЛ, 0.35 sq.mm
	a-13	Terminal	1050,1051		Valve	14	2,7	МГВСЛ, 2 sq.mm
	a-14	Valve	14	2,7	Same	34	2,7	Same
	a-15	Same	34	2,7	Same	42	2,7	Same
	a-17	Terminal	1050,1051		Same	13	2,7	Same

1	2	3	4	5	6	7	8	9
	a-18	Valve	13	2,7	Valve	12	2,7	МГВСЛ, 2 sq.mm
	a-19	Same	12	2,7	Same	11	7,8	Same
	a-20	Same	11	7,8	Same	9	2,7	Same
	a-22	Terminal	1050,1051		Same	6	2,7	Same
	a-23	Valve	6	2,7	Same	4	2,7	Same
	a-24	Same	4	2,7	Same	2	2,7	Same
45	a-26	Terminal	1050,1051		Tube	1	2,8	Same
	a-27	Valve	9	2	Switch	722	I-1-5	МГВСЛ, 0.35 sq.mm
	b-1	Connector	1017	2,3	Valve	3	7,8	МГВСЛ, 1 sq.mm
	c-1	Connector	1017	5,4	Valve	10	7,2	МГВСЛ, 0.35 sq.mm
	c-2	Valve	10	7,2	Same	7	7,2	Same
	f-1	Connector	1017	8,9	Same	5	7,8	Same
	0-1	Variable resistor	125	2,3	Same		Earth lug	ММ, 1.0 mm dia.
	0-2	Strip (terminal)	1	7, bottom			Same	МГВСЛ, 0.35 sq.mm
	0-3	Valve	4	1,8			Same	ММ, 1.0 mm dia.
23, 21, 20, 52	0-4	Strip	5	3, bottom	Same	18	Same	МГВСЛ, 0.35 sq.mm
	0-5	Same	4	1, bottom			Same	Same
	0-6	Valve	6	1,8			Same	, 1.0 mm dia.
	0-7	Capacitor	526	2			Same	МГВСЛ, 0.35 sq.mm
	0-8	Valve	42	1			Same	ММ, 1.0 mm dia.
	0-9	Strip	12	1, top			Same	МГВСЛ, 0.35 sq.mm
1, 2, 3	0-10	Same	10	1, top	Plug block		Same	Same
14, 9, 16	0-11	Variable resistor	475	3	СПС	1	Same	Same
30, 32, 61	0-12	Strip	6	11, bottom	Valve	15	Same	Same
	0-13	Same	7	5, bottom			Same	Same
	0-14	Same	8	5, bottom			Same	Same
	0-15	Valve	20	1			Same	ММ, 1.0 mm dia.
	0-16	Same	19	1			Same	Same
	0-17	Same	21	1			Same	Same
	0-18	Strip	9	7, bottom	Valve	21	1	МГВСЛ, 0.35 sq.mm
	0-19		284	Bottom			Earth lug	Same

1	2	3	4	5	6	7	8	9
	0-20	Strip	9	2, bottom			Earth lug	МГВСЛ, 0.35 sq.mm
30-58	0-21	Switch	728	4,8	Single-pin plug	771	Short	Same
	0-22	Single-pin plug	761		Plug block		Earth lug	Same
30	0-23	Switch	728	4,8	Switch	719	1	Same
30-59	0-24	Same	719	1	Same	720	1	Same
59	0-25	Same	720	1	Same	718	1	Same
3	0-26	Single-pin plug	794	Short	Plug block	–	Earth lug	МГВСЛ, 0.35 sq.mm
	0-27	Connector	1015	11	–	–	Same	ММ, 1.0 mm dia.
	0-28	Connector	1017	11	–	–	Same	Same
	0-29	Valve	9	1	–	–	Same	Same
	0-50	Same	12	1	–	–	Same	Same
5, 2, 6, 7	1-1	Variable resistor	123	1,2	Strip	1	2,top	МГВСЛ, 0.35 sq.mm
	1-2	Same	123	2	Valve	3	2	Same
7,6, 8	1-3	Strip	1	4, top	Same	5	5	Same
8, 6, 17, 21, 18	1-4	Valve	5	5	Strip	2	2, top	Same
34, 21, 20, 9, 6, 7	1-7	Variable resistor	154	2,3	Same	1	1, top	Same
29, 26, 38, 49	1-8	Strip	4	2, top	Connector	1017	13	Same
29, 26, 36	1-9	Same	1	3, top	Variable resistor	157	3	Same
27, 26, 36	1-10	Same		1, top	Same	157	3	Same
19, 17, 26, 27	1-11	Valve	10	3,5	Strip	3	8, top	Same
18, 17, 19	1-12	Strip	2	2, top	Valve	10	5	Same
	1-13	Adapter	3	3	Focusing coil	656		
62, 64	1-14	Same	3	3	Brush	658	1	Same
27, 26, 17, 63	1-15	Strip	3	1, top	Deflecting coil brush	657	2	Same
26, 29	1-16	Resistor	474	Top	Strip	4	3, top	Same
46, 20, 24, 26, 38, 41. 62	1-17	Strip	9	5, top	Adapter	3	3	Same

50X1-HUM

1	2	3	4	5	6	7	8	9
7, 6, 2, 1	1-18	Strip	1	1, top	Strip	10	3, top	МГВСЛ,
7, 6, 9, 20, 21, 22	1-19	Same	1	4, top	Same	5	4, top	Same
22, 21, 20, 9, 30, 32, 31	1-20	Same	5	4, top	Same	6	8, top	Same
31, 32, 61	1-21	Same	6	8, top	Valve	15	2	Same
61, 32, 30, 9, 20, 52, 53	1-22	Valve	15	5	Strip	7	3, top	Same
53, 52	1-23	Strip	7	1, top	Inductance coil	652	3 4	Same
52	1-24	Inductance coil	652	3,4	Valve	18	5	Same
52, 54, 60	1-25	Valve	18	5	Strip	8	8, top	Same
60, 54, 52, 20, 47	1-26	Strip	8	1, top	Valve	25	5	Same
47, 20, 46	1-27	Valve	25	5	Strip	9	6, top	Same
1, 2, 3	1-28	Strip	10	3, top	Single-pin plug	756	Body	Same
13, 9, 20, 21, 22	2-1	Variable resistor	143	1	Strip	5	10, top	Same
18, 17, 26, 27	2-2	Strip	2	4, top	Same	3	3, top	Same
22, 21, 17, 18	2-3	Same	5,	10, top	Same	2	4, top	Same
27, 25, 29	2-4	Same	3	3, top	Same	4	5, bot-tom	Same
29, 26, 38, 49	2-5	Same	4	8, top	Connector	1017	1	Same
29, 26, 24, 20, 46	2-6	Same	4	8, top	Strip	9	9, top	Same
14, 9, 16	2-7	Variable resistor	280	1	Variable resistor	283	1	Same
46, 20, 52, 54, 60	2-8	Strip	9	9, top	Strip	8	7, top	Same
30, 58	2-9	Same	6	6, bottom	Single-pin plug	766	Short	Same
60, 54, 52, 20	2-10	Same	8	7, top	Strip	6	9, top	Same
	2-11	Variable resistor	280	1	Variable resistor	143	1	Same
16, 9, 15	2-12	Same	283	1	Switch	726	4	Same
	3-1	Connector	1004	-	Tube	1		

1	2	3	4	5	6	7	8	9
49, 38, 51	A-1	Connector	1017	10	Connector	1015	10	МГВСЛ, 0.35 sq.
49, 38, 43	B-1	Same	1017	18	Resistor СПЭ	101	2	
43, 38, 51	B-2	Resistor СПЭ	101	2	Connector	1015	12	Same
43, 37, 26, 24, 20, 9, 30	B-3	Same	101	2	Strip	11	1, bottom	Same
5, 2, 4	5-1	Variable resistor	123	3	Variable resistor	124	1	МГВСЛ, 0.35 sq
4, 2, 1	5-2	Same	124	1	Strip	10	5, top	Same
4, 2, 6, 21, 33	6-1	Same	124	2	Switch 2-2-3	722	1-2-5	Same
4, 2, 5	7-1	Same	124	3	Variable resistor	125	1	Same
5, 2, 9, 10	7-2	Same	125	1	Same	119	1	Same
10, 9, 11	7-3	Same	119	1	Same	120	1	Same
10, 9, 6, 21, 33	8-1	Same	119	2	Switch 2-2-3	722	1-2-3	Same
11, 9, 6, 21, 33	9-1	Same	120	2	Same	722	1-2-4	Same
11, 9, 10	10-1	Same	120	3	Variable resistor	119	3	Same
10, 9, 2	10-2	Same	119	3	Strip	10	5, bottom	МГВСЛ, 0.35 sq
7, 6, 21, 35	11-1	Strip	1	8, top	Switch 2-2-3	722	1-2-0	Same
7, 6, 8	11-2	Same	1	9, top	Capacitor	502	–	Same
	12-1	Valve	2	4	Strip	1	2, bottom	Same
5, 2, 6, 7	13-1	Same	2	8	Same	1	3, top	Same
	14-1	Same	2	5	Same	1	4, bottom	Same
	15-1	Same	2	3	Same	1	1, bottom	Same
	15-2	Same	2	3	Valve	3	1, 4, 5	Same
	16-1	Same	2	6,1	Strip	1	6, bottom	Same
7, 6, 2	17-1	Strip	1	6, top	Single-pin plug	752	Long	Same
	18-1	Same	1	5, bottom	Valve	4	4	Same
	19-1	Valve	3	3	Strip	1	10, bottom	Same
7, 6, 2	20-1	Strip	1	10, top	Single-pin plug	753	Long	Same

1	2	3	4	5	6	7	8	9
	21-1	Valve	3	8	Strip	1	9, bottom	МГВСЛ, 0.35 sq.mm
5, 2, 3	21-2	Same	3	8	Single-pin plug	796	Short	Same
	23-1	Same	3	6	Strip	1	8, bottom	Same
	23-2	Strip	2	1, bottom	Same	1	8, bottom	Same
	24-1	Same	2	1, top	Switch	721	1	Same
8	25-1	Valve	4	3	Blocking transformer	651	6	Same
6,8	26-1	Same	4	6	Same	651	2	Same
6, 8	27-1	Same	4	5	Same	651	3	Same
8, 6, 17, 26, 29	28-1	Blocking transformer	651	5	Strip	4	2, bottom	Same
8, 6, 17, 18	29-1	Same	651	1	Same	2	3, top	Same
8, 6, 21, 22	30-1	Same	651	4	Same	5	6, top	Same
23, 21, 20, 9, 14	31-1	Strip	5	6, bottom	Variable resistor	136	2	Same
23, 21, 6, 8	31-2	Same	5	6, bottom	Capacitor	507	–	Same
14, 9, 20, 21, 23	32-1	Variable resistor	136	1	Strip	5	10, bottom	Same
14, 9, 20, 21, 22	33-1	Same	136	3	Same	5	11, top	Same
22, 21, 20, 9, 23	34-1	Strip	5	5, top	Variable resistor	143	3	Same
13, 9, 6, 8	35-1	Variable resistor	143	2	Capacitor	510	–	Same
[illegible], 6, 17, 18	35-2	Capacitor	510	–	Strip	2	11, top	Same
	36-1	Valve	5	2	Switch	721	3,4	Same
	37-1	Switch	721	2	Strip	2	3, bottom	Same
	37-2	Strip	2	3, bottom	Valve	6	3	Same
	37-3	Valve	6	3	Capacitor	511	Bottom	Same
	37-4	Same	7	3	Same	511	Bottom	Same
	38-1	Capacitor	511	Top	Valve	5	4	Same
	39-1	Valve	5	1	Strip	2	10, bottom	Same
	40-1	Strip	2	9, bottom	Through contact	1014 1013		

1	2	3	4	5	6	7	8	9
8, 6, 2	41-1	Valve	5	3	Strip	10	1, bottom	МГВСЛ, 0.35 sq.mm
2	41-2	Strip	10	1, bottom	Single-pin plug	754	Long	Same
8, 6, 21, 22	42-1	Valve	5	8	Strip	5	2, top	Same
8, 6, 2	42-2	Same	5	8	Single-pin plug	809	Long	Same
8, 6, 17, 19	43-1	Valve	5	6	Capacitor	517	Bottom	Same
19, 17, 26, 27	43-2	Capacitor	517	Bottom	Strip	3	2, bottom	Same
27, 26, 28	43-3	Strip	3	2, bottom	Capacitor	566	Top	Same
27, 26, 24, 20, 9, 2	44-1	Same	3	2, top	Strip	10	2, bottom	Same
2	44-2	Same	10	2, bottom	Single-pin plug	755	Long	Same
	45-1	Valve	6	6	Strip	2	6, bottom	Same
	45-2	Same	7	8	Same	2	6, bottom	Same
18, 17, 24, 20, 9, 2	46-1	Strip	2	6, top	Same	10	3, bottom	Same
2	46-2	Same	10	3, bottom	Single-pin plug	756	Long	Same
	47-1	Valve	6	5	Strip	2	8, bottom	Same
18, 17, 21, 33	48-1	Strip	2	8, top	Switch 2-2-3	722	II-2-0	Same
35, 21, 34	48-2	Switch 2-2-3	722	II-2-5	Variable resistor	154	1	Same
35, 21, 34	48-3	Same	722	II-2,3,4	Same	153	1	Same
29, 26, 17, 21, 34	49-1	Strip	4	1, top	Same	153		Same
	50-1	Valve	6	4	Strip	2	4, bottom	Same
19, 17, 26, 36	51-1	Same	7	4	Variable resistor	157	2	Same
19	51-2	Same	7	4	Capacitor	515	–	Same
19, 17, 26, 37	52-1	Same	7	5	Variable resistor	158	2	Same
19	52-2	Same	7	5	Capacitor	516	–	Same
37, 26, 36	53-1	Variable resistor	158	3	Variable resistor	157	1	Same
29, 26, 37	54-1	Strip	4	7, top	Same	158	1	Same
	55-1	Capacitor	517	Top	Valve	9	4	Same
27, 26, 17, 19	55-2	Strip	3	1, bottom	Capacitor	517	Top	Same
19	56-1	Valve	9	3	Valve	11	1	Same

1	2	3	4	5	6	7	8	9
19, 17, 21, 33	56-2	Valve	9	3	Switch 2-2-3	722	II-1-0	МГВСЛ, 0.35 sq.mm
33	56-3	Switch 2-2-3	722	II-1-5	Strip	12	1, bottom	Same
33	56-4	Strip	12	2, bottom	Switch 2-2-3	722	II-1-4	Same
33	56-5	Same	12	3, bottom	Same	722	II-1-3	Same
33, 21, 34	56-6	Same	12	1, bottom	Variable resistor	171	3	Same
34, 21, 33	56-7	Variable resistor	172	3	Strip	12	2, bottom	Same
21, 33	56-8	Strip	12	3, bottom	Variable resistor	173	3	Same
22, 21, 34	57-1	Same	5	7, top	Same	171	2	Same
22, 21, 34	58-1	Same	5	8, top	Same	172	2	Same
22, 21	59-1	Same	5	9, top	Same	173	2	Same
23, 21, 17, 19	60-3	Same	5	7, bottom	Valve	10	4,8	Same
	60-4	Valve	10	4,8	Capacitor	525	Top	Same
19, 17, 26, 27	61-1	Same	9	6	Strip	3	10, top	Same
27, 26, 28	61-2	Strip	3	10, top	Capacitor	530	1	Same
19	61-3	Valve	11	5	Valve	9	6	Same
	62-1	Same	11	2	Strip	3	6, bottom	Same
19, 17, 26, 28	62-2	Same	11	2	Capacitor	527	1	Same
27, 26, 28	63-1	Strip	3	6, top	Same	526	1	Same
28, 26, 17, 19	64-1	Capacitor	527	2	Valve	11	4	Same
19, 17, 24, 20, 29	65-1	Valve	11	6	Strip	10	4, bottom	Same
2	65-2	Strip	10	4, bottom	Single-pin plug	759	Long	Same
	66-1	Valve	11	3	Strip	3	5, bottom	Same
27, 26, 17, 19	67-1	Strip	3	5, top	Capacitor	525	Bottom	Same
19, 17, 26, 28	67-2	Capacitor	525	Bottom	Valve	13	8	Same
	67-3	Valve	13	8	Same	14	8	Same
	67-4	Same	14	8		196	Top	Same
28	68-1	Capacitor	530	2	Valve	12	4,8	Same
28, 26, 27	68-2	Valve	12	4,8	Strip	3	11, top	Same
28	69-1	Same		3,5	Capacitor	531	–	Same
27, 26, 28	69-2	Strip	3	3, bottom	Same	531	–	Same

1	2	3	4	5	6	7	8	9
28, 26, 27	70-1	Valve	13	4	Strip	3	9, top	МГВСЛ, 0.35 sq.mm
28, 26, 24, 25	71-1	Resistor СПЭ	196	Bottom	Variable resistor	197	3	Same
25, 24, 20, 21, 22	72-1	Variable resistor	197	1, 2	Strip	5	1, top	Same
22, 21, 20,	72-2	Strip	5	1, top	Single-pin plug	760	Long	Same
	73-1	Same	3	11, bottom	Valve	14	5	Same
	74-1	Same	3	8, bottom	Same	13	3	Same
	74-2	Valve	13	3	Same	14	3	Same
28, 26, 17, 63	74-3	Same	14	3	Brush	657	1	Same
28, 26, 38, 41	75-1	Same	34	3	Adapter	3	4	Same
	75-2	Adapter	3	4	Focusing coil	656		Same
62, 47, 20, 24, 26	76-1	Valve	26	3	Switch	729	2	Same
38, 41, 64	74-4	Same	13	3	Same	729	4	Same
	77-1	Same	34	4	Strip	4	9, bottom	Same
	78-1	Same	34	8	Same	4	10, top	Same
28	79-1	Same	34	5	Capacitor	599		Same
28, 26, 24, 20, 9, 14	79-2	Capacitor	599		Variable resistor	475	2	Same
14, 9, 20, 24, 26, 29	80-1	Variable resistor	475	1	Strip	4	5, top	Same
	81-1	Valve	42	3	Resistor СПЭ-II	471	Bottom	Same
45, 20, 24, 26	81-2	Tube	1	3	Same	471	Bottom	Same
	82-1	Valve	42	8	Strip	4	4, bottom	Same
	83-1	Same	42	5	Same	4	6, bottom	Same
	83-2	Valve	42	5	Capacitor	566	Bottom	Same
52, 20, 21, 23	84-1	Same	17	4	Strip			Same
52, 53	84-2	Same	17	4	Same	7	1, bottom	Same
53, 52, 20, 9, 30, 32	84-3	Strip	7	1, bottom	Capacitor	541	–	Same
23, 21, 20 9, 12	84-4	Same	5	2, bottom	Variable resistor	208	3	Same

1	2	3	4	5	6	7	8	9
	84-5	Variable resistor	208	1	Variable resistor	207	1	МГВСЛ, 0.35 sq.mm
12, 9, 30, 32	85-1	Same	208	2	Capacitor	537	—	Same
32, 30	85-2	Capacitor	537	—	Switch	728	7	Same
11, 9, 30, 32	86-1	Variable resistor	207	2	Capacitor	536	—	Same
32, 30	86-2	Capacitor	536	—	Switch	728	3	Same
	87-1	Variable resistor	207	3	Variable resistor	208	3	Same
12, 9, 30, 32, 31	87-2	Same	208	1	Strip	6	1, top	Same
	88-1	Valve	15	1	Same	7		Same
53, 52, 20, 9, 30	89-1	Strip	7	9, top	Switch	728	1,2	Same
	90-1	Valve	15	3	Strip	7	11, bottom	Same
	90-2	Strip	7	11, bottom	Valve	16	3	Same
53, 52, 20, 9, 30	91-1	Same	7	10, top	Single-pin plug	761	Long	Same
	92-1	Valve	15	6	Strip	7	7, bottom	Same
	92-2	Strip	7	7, bottom	Valve	16	5	Same
	93-1	Valve	15	4	Strip	7	8, bottom	Same
53, 52, 20, 9, 30	94-1	Strip	7	8, top	Switch	728	5-6	Same
53, 52, 20, 9, 30	95-1	Same	7	6, top	Single-pin plug	762	Long	Same
52, 53	96-1	Valve	16	4	Variable resistor	216	3	Same
52, 53	97-1	Valve	16	8	Variable resistor	217	3	Same
	98-1	Variable resistor	216	2,1	Same	217	2,1	Same
	98-2	Same	217	2,1	Strip	7	4, bottom	Same
	98-3	Strip	7	4, bottom	Valve	17	3,5	Same
52	98-4	Valve	17	3,5	Capacitor	540	1	Same
53, 52, 20, 9, 30	99-1	Strip	7	4, top	Single-pin plug	763	Long	Same
52	100-1	Capacitor	540	2	Valve	17	6	Same

1	2	3	4	5	6	7	8	9
	100-2	Valve	17	6	Strip	7	3, bottom	МГВСЛ, 0.35 sq.mm
	101-1	Same	17	8	Same	7	2, bottom	Same
	101-2	Same	17	8	Capacitor	545	Top	Same
	102-1	Strip	7	2, top	Inductance coil	652	1,2	Same
	103-1	Capacitor	545	Bottom	Valve	18	3,4	Same
55, 54, 52	104-1	Same	542	–	Same	18	1,2	Same
52, 20, 9, 14	104-2	Valve	18	1,2	Variable resistor	280	2	Same
52, 54, 55	105-1	Same	18	6	Strip	8	4, bottom	Same
55, 54, 52, 20, 45	105-2	Strip	8	4, bottom	Tube	1	5	Same
50, 54, 52, 20, 9, 30, 32, 31	106-1	Same	8	4, bottom	Strip	6	6, top	Same
31, 32, 30	106-2	Same	6	6, top	Single-pin plug	766	Long	Same
	107-1	Same	8	9, bottom	Valve	19	4	Same
	108-1	Same	8	11, bottom	Capacitor	548	Top	Same
	109-1	Capacitor	548	Bottom	Through contact	1005		Same
60, 55	110-1	Strip	8	6, top	Capacitor	550	–	Same
60, 54, 52, 20, 9, 30, 59	111-1	Same	8	5, top	Switch	718	3	Same
	112-1	Same	8	10, top	Valve	19	8	Same
	112-2	Valve	19	8	Same	20	8	Same
	112-3	Same	20	8	Same	21	8	Same
55	113-1	Valve	19	6	Strip	8	1, bottom	Same
55, 54, 52	113-2	Strip	8	1, bottom	Capacitor	547		Same
47, 20, 48	114-1	Valve	19	3,5	Variable resistor	243	3	Same
48, 20, 9, 30, 32, 31	115-1	Variable resistor	243	2,1	Strip	6	5, top	Same
31, 32, 30,	115-2	Strip	6	5, top	Single-pin plug	767	Long	Same
	116-1	Inductance coil	653	1,2	Strip	8	10, bottom	Same
	117-1	Inductance coil	653	4,3	Same	8	8, bottom	Same
52	117-2	Same	653	3,4	Capacitor	552	–	Same

1	2	3	4	5	6	7	8	9
60, 54, 52, 20, 9, 30, 32, 31	118-1	Strip	8	2, top	Strip	6	10, top	МГВСЛ, 0.35 sq
60, 55	118-2	Same	8	2, top	Capacitor	558		Same
31, 32, 30	119-1	Same	6	11, top	Switch	719	3	Same
	120-1	Same	8	2, bottom	Valve	20	4	Same
	121-2	Same	8	3, bottom	Capacitor	553,	Bottom	Same
	122-1	Capacitor	553	Top	Through contact	1009, 1010		Same
47, 20, 48	123-1	Valve	20	3,5	Variable resistor	255	3	Same
48, 20, 9, 30, 32, 31	124-1	Variable resistor	255	1,2	Strip	6	4, top	Same
31, 32, 30	124-2	Strip	6	4, top	Single-pin plug	768	Long	Same
47	125-1	Valve	20	6	Strip	9	5, bottom	Same
47	125-2	Strip	9	5, bottom	Capacitor	556		Same
46, 20, 47	126-1	Same	9	10, top	Same	551		Same
46, 20, 9, 30, 59	127-1	Same	9	8, top	Switch	720	3	Same
	128-1	Capacitor	555	Top	Through contact	1545, 1546		Same
	129-1	Same	555	Bottom	Strip	9	11, bottom	Same
	130-1	Valve	21	4	Same	9	10, bottom	Same
47, 20, 48	131-1	Same	21	3,5	Variable resistor	465	3	Same
48, 20, 9, 30, 32, 31	132-1	Variable resistor	465	2,1	Strip	6	3, top	Same
31, 32, 30	132-2	Strip	6	3, top	Single-pin plug	769	Long	Same
	133-1	Valve	21	6	Strip	9	6, bottom	Same
47	133-2	Strip	9	6, bottom	Capacitor	557	–	Same
	134-1	Valve	25	3	Same	9	3, bottom	Same
47	134-2	Strip	9	3, bottom	Capacitor	560	–	Same
46, 20, 9, 14	134-3	Same	9	2, top	Variable resistor	280	3	Same
	137-1	Same	25	6	Strip	9	4, bottom	Same

1	2	3	4	5	6	7	8	9
47, 20, 45	137-2	Strip	9	4, bottom	Tube	1	7	МГВСЛ, 0.35 sq.mm
46, 20, 9, 30, 32, 31	138-1	Same	9	4, top	Strip	6	2, top	Same
31, 32, 30	138-2	Same	6	2, top	Single-pin plug	771	Long	Same
30, 9, 16	139-1	Same	6	8, bottom	Variable resistor	283	3	Same
16, 9, 15	140-1	Variable resistor	283	2	Switch	726	3	Same
16, 9, 20, 47	140-2	Same	283	2	Capacitor	565		Same
47, 20, 9, 15		Valve	26	5	Switch	726	1, 2	Same
	142-1	Same	26	8	Resistor СПЭ	284	Top	
	143-1	Resistor СПЭ	103	2	Same	102	2	ММ, 1.0 mm dia.
	144-1	Same	102	1	Same	101	1	Same
51, 38, 26, 24, 20, 44	145-1	Connector	1015	6	Same	103	1	МГВСЛ, 0.35 sq.mm
44, 20, 9, 30, 57	145-2	Resistor СПЭ	103	1	Strip	11	4, top	Same
30, 58	145-3	Strip	11	2, bottom	Single-pin plug	812	Short	Same
44, 20, 24 26, 36, 42	145-5	Resistor СПЭ	103	1	Motor armature	701	Я-1	Same
51, 38, 42	146-1	Connector	1015	9	Same	701	Я-2	Same
42, 38, 26, 24, 20, 9, 30, 57	146-2	Motor armature	701	Я-2	Strip	11	3, top	Same
30	147-1	Strip	11	4, bottom	Single-pin plug	812	Long	Same
57, 30	148-1	Same	11	1, top	Same	811	Long	Same
51, 38, 42	149-1	Connector	1015	7	Motor field winding	701	М-2	Same
51, 38, 42	150-1	Same	1015	8	Same	701	М-1	Same
51, 38, 40	151-1	Same	1015	4	Adapter	1	5	Same
	151-2	Adapter	1	5	Selsyn	702	Р-2	Same
51, 38, 40	152-1	Connector	1015	3	Adapter	1	4	Same
	152-2	Adapter	1	4	Selsyn	702	Р-1	Same
51, 38, 39	153-1	Connector	1015	2	Adapter	2	5	Same

1	2	3	4	5	6	7	8	9
	153-2	Adapter	2	5	Selsyn	703	P-2	МГВСЛ, 0.35 sq.mm
51, 38, 39	154-1	Connector	1015	1	Adapter	2	4	Same
	154-2	Adapter	2	4	Selsyn	703	P-1	Same
38, 26, 24, 20, 9, 30	155-1	Connector	1016	8	Switch	719	5	Same
38, 26, 24, 20, 9, 30	156-1	Same	1016	7	Same	719	7	Same
50, 38, 40	157-1	Same	1016	6	Adapter	1	3	Same
	157-2	Adapter	1	3	Selsyn	702	C-3	Same
50, 38, 40	158-1	Connector	1016	5	Adapter	1	2	Same
	158-2	Adapter	1	2	Selsyn	702	C-2	Same
50, 38, 40	159-1	Connector	1016	4	Adapter	1	1	Same
	159-2	Adapter	1	1	Selsyn	702	C-1	Same
50, 38, 39	160-1	Connector	1016	3	Adapter	2	3	Same
	160-2	Adapter	2	3	Selsyn	703	C-3	Same
50, 38, 39	161-1	Connector	1016	2	Adapter	2	2	Same
	161-2	Adapter	2	2	Selsyn	703	C-2	Same
50, 38, 39	162-1	Connector	1016	1	Adapter	2	1	Same
	162-2	Adapter	2	1	Selsyn	703	C-1	Same
22, 21, 20, 9, 2	163-1	Strip	5	3, top	Single-pin plug	793	Long	Same
9, 2	164-1	Strip	4	11, top	Single-pin plug	794	Long	Same
19, 17, 24, 20, 9, 2	165-1	Valve	9	8	Same	758	Long	Same
28, 26, 27	167-1	Same	14	4	Strip	3	4, top	Same
19, 17, 21, 20, 9, 2, 3	168-1	Same	7	2	Single-pin plug	797		Same
19, 17, 24, 20, 9, 2	169-1	Same	7	7	Same	797	Long	Same
8, 6, 2, 3	170-1	Same	5	7	Same	809	Short	Same

1	2	3	4	5	6	7	8	9
5, 2	173-1	Valve	3	7	Single-pin plug	796	Long	МГВСЛ, 0.35 sq.mm
5,2	174-1	Same	2	7	Same	795		Same
5, 2, 3	175-1	Same	2	2	Same	795	Body	Same
30	176-1	Strip	6	7, bottom	Switch	727	1	Same
30, 9, 2, 4	176-2	Switch	727	3	Valve	82	Terminal	Same
	176-4	Same	727	4	Same	81	Same	Same
33, 6, 2	177-1	Switch 2-2-3	722	1-1-5	Same	83	Same	Same
	180-1	Valve	26	4	Strip	9	1, bottom	Same
	181-1	Resistor	474	Bottom	Resistor	471	Top	Same
	200	Connector	1008		Through contact			РК-31
	201	Same	1007		Same			Same
	202	Same	1006		Same			Same
	203	Same	1005		Same			Same
	204	Same	1012		Same			Same
	205	Same	1011		Same			Same
	206	Same	1010		Same			Same
	207	Same	1009		Same			Same
	208	Same	1545		Same			Same
	209	Same	1546		Same			Same
	210	Same	1014		Same			Same
	211	Same	1013		Same			
	212-1	Switch	729	7	Expand coil	658	2	Same

WIRE TABLE TO WIRING DIAGRAM OF HEIGHT INDICATOR (UNIT HO-02)
(Figs 21 and 22)

No. of wire bundle	No. of wire	From			To			Type and cross-section of wire
		Part	Ref. No. in key diagram	No. of contact	Part	Ref. No. in key diagram	No. of contact	
1	2	3	4	5	6	7	8	9
	a-1	Terminal	1087, 1088		Valve	46	2,7	МГВСЛ, 2.0 sq
	a-2	Valve	46	2,7	Same	24	2,7	Same
	a-3	Same	24	2,7	Same	14	2,7	Same
	a-4	Same	14	2,7	Same	34	2,7	Same
	a-6	Terminal	1087, 1088		Same	23	7,8	Same
	a-7	Valve	23	7,8	Same	22	7,8	Same
	a-8	Same	22	7,8	Same	25	7,8	Same
	a-9	Same	25	7,8	Same	33	7,8	Same
	a-11	Terminal	1087, 1088		Same	21	2,7	Same
	a-12	Valve	21	2,7	Same	17	2,7	Same
	a-13	Same	17	2,7	Same	18	7,8	Same
	a-14	Same	18	7,8	Same	20	2,7	Same
	a-16	Terminal	1087, 1088		Same	16	2,7	Same

1	2	3	4	5	6	7	8	9
	a-17	Valve	16	2,7	Valve	15	7,8	МГВСЛ, 2.0 sq.mm
	a-18	Same	15	7,8	Same	47	7,8	Same
	a-20	Terminal	1087, 1088		Same	41	2,7	Same
	a-21	Valve	41	2,7	Same	43	7,8	Same
	a-22	Same	43	7,8	Same	38	7,8	Same
	a-23	Same	38	7,8	Same	37	2,7	Same
	a-25	Terminal	1087, 1088		Same	45	2,7	Same
	a-26	Valve	45	2,7	Same	27	7,8	Same
	a-27	Same	27	7,8	Same	40	7,8	Same
	a-28	Same	40	7,8	Same	44	2,7	Same
	a-30	Terminal	1087, 1088		Same	50	2,7	Same
	a-31	Valve	50	2,7	Valve	51	2,7	Same
	a-32	Same	51	2,7	Same	48	2,7	Same
	a-34	Terminal	1087, 1088		Same	49	2,7	Same
	a-36	Valve	49	2,7	Same	42	2,7	Same
	a-37	Same	42	2,7	Same	53	2,7	Same
	a-39	Terminal	1087, 1088		Same	13	2,7	Same
	a-40	Valve	13	2,7	Same	11	7,8	Same
	a-41	Same	11	7,8	Same	6	2,7	Same
	a-42	Same	6	2,7	Same	9	2,7	Same
	a-43	Same	9	2,7	Same	12	2,7	Same
	c_1	Connector	1086	4,5	Same	10	2,7	МГВСЛ, 1.0 sq.mm
	d_1	Same	1086	6,7	Same	28	7,8	Same
	f_1	Same	1086	8,9	Same	5	7,8	Same
	0-3	Valve	6	1,8	Earth			ММ, 1.0 mm dia.
	0-4	Capacitor	526	1	Same			Same
	0-5	Valve	13	1	Same			Same

1	2	3	4	5	6	7	8	9
	0-6	Valve	12	1	Valve			ММ, 1.0 mm dia.
	0-7	Same	42	1	Same			Same
	0-8	Same	49	1	Same			Same
	0-10	Same	48	1	Same			Same
	0-11	Same	51	8-1	Same			Same
	0-13	Same	9	1	Same			Same
	0-14	Variable resistor	163	3	Same			МГВСЛ, 0.35 sq.mm
	0-15	Valve	14	1	Same			ММ, 1.0 mm dia.
	0-16	Strip (terminal)	6	1, bottom	Same			МГВСЛ, 0.35 sq.mm
	0-17	Valve	53	1	Same			ММ, 1.0 mm dia.
	0-18	Same	50	3-5	Same			Same
	0-19	Strip	9	8, bottom	Same			МГВСЛ, 0.35 sq.mm
	0-20	Valve	17	1	Same			ММ, 1.0 mm dia.
	0-21	Same	21	1	Same			Same
	0-22	Same	20	1	Same			Same
	0-23	Resistor	203	Bottom	Earth			МГВСЛ, 0.35 sq.mm
	0-24	Valve	24	4-8-1	Same			ММ, 1.0 mm dia.
	0-25	Same	46	1	Same			Same
	0-26	Resistor	425	Bottom	Same			Same
	0-28	Capacitor	593	1	Same			МГВСЛ, 0.35 sq.mm
	0-29	Variable resistor	403	1-2	Same			ММ, 1.0 mm dia.
	0-30	Valve	37	1	Same			МГВСЛ, 0.35 sq.mm
	0-31	Same	41	3	Same			ММ, 1.0 mm dia.
	0-32	Same	38	3-6	Same			Same
	0-33	Strip	14	3, bottom	Same			МГВСЛ, 0.35 sq.mm
	0-34	Valve	44	1-4	Same			ММ, 1.0 mm dia.
	0-35	Same	45	1	Same			Same
	0-36	Connector	1084	11	Same			Same
	0-37	Same	1085	1	Same			Same
	0-38	Same	1086	11	Same			Same
	0-39	Variable resistor	420	3	Same			МГВСЛ, 0.35 sq.mm

1	2	3	4	5	6	7	8	9
	0-40	Variable resistor	311	3	Earth			МГВСЛ, 0.35 sq.mm
	0-41	Same	385	1	Same			Same
	0-42	Same	201	3	Same			Same
	0-43	Same	475	3	Same			Same
18-2	0-44	Same	417	1	Earth lug	2		Same
12-1	0-45	Single-pin plug			Strip (terminal)	17	6, top	Same
12-2	0-46	Strip	17	7, top	Earth lug		2	
12-1	0-47	Switch	728	3-7	Strip	17	8, top	
	0-48	Strip	11	4, top	Earth			
19, 3, 20	0-49	Same	16	9, top	Single-pin plug	794		Same
	0-50	Valve	10	1	Earth			Same
19, 3, 55	0-51	Strip	16	8, top	Earth lug			Same
	0-52	Capacitor	588, 589		Same			ММ, 0.1 mm dia.
43-4-38	1-4	Valve	5	5	Strip	8	6, bottom	МГВСЛ, 0.35 sq.mm
38-4	1-5	Strip	8	6, bottom	Valve	10	3-5	Same
42-4-38	1-6	Same	8	3, bottom	Variable resistor	153	2-3	Same
	1-7	Valve	10	3-5	Strip	3	1, bottom	ММ, 1.0 mm dia.
44-4-46	1-8	Strip	3	3, top	Same	4	4, top	МГВСЛ, 0.35 sq.mm
46-10	1-9	Same	4	4, top	Resistor	474	Top	Same
10-48	1-10	Resistor	474	Top	Strip	5	2, top	Same
48-10-49	1-11	Strip	5	4, top	Same	7	2, top	Same
51-52-49-10	1-12	Same	7	10, top	Connector	1086	13	Same
48-39	1-13	Same	5	10, top	Valve	27	2-5	Same
35-7-10-39	1-14	Valve	27	5-2	Strip	13	9, top	Same
31-9-7-35	1-15	Strip	13	10, top	Strip	11	10, top	Same
	1-19	Valve	27	2-5	Valve	40	2	ММ, 1.0 mm dia.
31, 9, 32	1-20	Strip	11	10, top	Same	25	5	МГВСЛ, 0.35 sq.mm
27, 31, 32	1-21	Valve	25	5	Same	22	2	Same
	1-22	Same	22	2	Same	23	5	ММ, 0.1 mm dia.
	[illegible]	Same	23	5	Strip	10	3, top	МГВСЛ, 0.35 sq.mm

1	2	3	4	5	6	7	8	9
24, 9, 26	1-24	Strip	10	10, top	Valve	18	5	МГВСЛ, 0.35 sq.mm
	1-25	Valve	18	5	Inductance coil	652	3,4	ММ, 1.0 mm dia.
23, 8, 24	1-26	Inductance coil	652	3,4	Strip	9	3, top	МГВСЛ, 0.35 sq.mm
23, 22	1-27	Strip	9	3, top	Valve	15	2-5	Same
22, 6, 5, 21	1-28	Valve	15	2-5	Same	47	2	Same
49, 10, 41	1-29	Strip	7	2, top	Strip	14	2, top	Same
41, 10, 11, 53	1-30	Same	14	2, top	Same	15	2, top	Same
52, 11, 53	1-31	Same	15	2, top	Connector	1084	13	Same
38, 4, 2, 1	1-32	Same	8	5, bottom	Strip	17	2, top	Same
12, 1, 13	1-33	Same	17	2, top	Single-pin plug	756		Same
19-3-2-5-21	1-34	Valve	47	2	Strip	16	7, top	Same
58-38-4	1-36	Strip	8	4, bottom	Adapter	2	1	Same
	1-37	Adapter	2	1	Deflection coil	659	2	Same
	1-38	Adapter	2	1	Focusing coil	656	2	Same
18-2-4-37	2-2	Strip	8		Variable resistor	280	1	Same
47-4-37	2-3	Same	8	10, top	Strip	3	4, top	Same
44-4-46	2-4	Same	3	4, top	Same	4	11, top	Same
46-10-48	2-5	Same	4	11, top	Same	5	6, top	Same
48-10-49	2-6	Same	5	11, top	Same	7	9, top	Same
49-10-50	2-7	Same	6	3, top	Same	7	9, top	Same
52-51 49-10	2-8	Same	7	6, top	Connector	1086	1	Same
49-10-41	2-9	Same	7	6, top	Strip	14	1, top	Same
35-7-10-53	2-10	Same	15	3, top	Same	13	8, top	Same
35-7-9-31	2-11	Same	13	8, top	Same	11	11, top	Same
19-3-2-5-7--9-31	2-13	Same	11	9, top	Same	16	11, top	Same
52-11-53	2-14	Same	15	3, top	Connector	1084	1	Same
	2-15	Same	14	1, top	Strip	15	5, top	Same
12-1-13	2-16	Same	17	4, top	Single-pin plug	770		Same
12-1-2-4-10-48	2-17	Same	5	6, top	Strip	17	3, top	Same
19-3-20	2-18	Same	16	10, top	Single-pin plug	804		Same

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1	2	3	4	5	6	7	8	9
	3-1	Connector	1044		Tube	1	Anode cap	ПВЛ-1
18-2-4-44	29-1	Variable resistor	143	2	Strip	3	11, top	МГВСЛ, 0.35 sq.mm
	31-1	Valve	5	2	Capacitor	511	Bottom	Same
	31-2	Capacitor	511	Bottom	Valve	6	3	Same
	31-3	Valve	6	3	Strip	3	3, bottom	Same
	32-1	Same	51	6	Same	7	8, bottom	Same
	33-1	Capacitor	511	Top	Valve	5	4	Same
	34-1	Valve	5	6	Strip	3	8, bottom	Same
	34-2	Strip	3	8, bottom	Capacitor	517	Bottom	Same
45, 4, 10, 47	34-3	Capacitor	517	Bottom	Same	566	Top	Same
47, 10, 11	34-4	Same	566	Top	Same	592	Top	Same
	35-1	Strip	3	9, bottom	Connector	1082		Same
	36-1	Valve	5	1	Strip	3	10, bottom	Same
37-4-2-1	37-1	Strip	8	7, top	Single-pin plug	754		Same
1-2-4-44	38-1	Same	3	8, top	Strip	17	8, bottom	Same
1	38-2	Same	17	8, bottom	Single-pin plug	755		Same
43-4-38	39-1	Valve	5	8	Strip	8	1, bottom	Same
37-4-2-3-20		Strip	8	1, bottom	Single-pin plug	809		Same
	40-1	Valve	6	4	Strip	3	4, bottom	Same
	41-1	Valve	6	6	Same	3	5, bottom	Same
1-2-4-44	42-1	Strip	3	6, top	Same	17	2, bottom	Same
1	42-2	Same	17	2, bottom	Single-pin plug	756		Same
	43-1	Valve	6	5	Strip	3	7, bottom	Same
42-4-44	44-1	Strip	3	7, top	Variable resistor	153	1	Same
44-4-45	45-1	Same	3	1, top	Capacitor	517	Top	Same
	45-2	Capacitor	517	Top	Valve	9	4	Same
1-2-4-45	46-1	Valve	9	8	Single-pin plug	758		
	47-1	Same	9	3	Valve	11	1	Same
42-4-45	47-2	Valve	11	1	Variable resistor	175	2	Same
	47-3	Same	9	3	Capacitor	522	1	Same
	48-1	Same	9	6	Valve	11		Same

1	2	3	4	5	6	7	8	9
	48-2	Valve	9	6	Capacitor	530	1	МГВСЛ, 0.35 sq.[illegible]
45-4-46	48-3	Same	11	5	Strip	4	3, top	Same
37-4-43	49-1	Same	10	8-4	Same	8	2, top	Same
	49-2	Same	10	4-8	Capacitor	525	Bottom	Same
42-4-38	50-1	Variable resistor	175	3	Strip	8	2, bottom	Same
43-4-46	51-1	Capacitor	522	2	Variable resistor	163	1-2	Same
4	52-1	Same	525	Top	Resistor	196	Bottom	Same
	52-2	Resistor	196	Bottom	Valve	13	8	Same
	52-3	Valve	13	8	Strip	4	5, bottom	Same
45-4-46	53-1	Strip	4	5, top	Valve	11	3	Same
45-4-46	54-1	Same	4	1, top	Valve	11	2	Same
	54-2	Valve	11	2	Capacitor	527	1	Same
	55-1	Capacitor	527	2	Valve	11	4	Same
1-2-4-45	56-1	Valve	11	6	Single-pin plug	759		Same
	57-1	Capacitor	530	2	Valve	12	8-4	Same
45-4-10-50	58-1	Valve	12	5-3	Capacitor	531		Same
	58-2	Same	12	5-3	Strip	4	11, bottom	Same
18-4	59-1	Resistor	196	Top	Variable resistor	197	3	Same
1-2-18	60-1	Variable resistor	197	1-2	Strip	17	7, bottom	Same
1	60-2	Strip	17	7, bottom	Single-pin plug	760		
	61-1	Valve	13	4	Strip	4	4, bottom	Same
45-4-58	62-1	Same	13	3	Adapter	2	3	Same
	62-2	Adapter	2	3	Deflection coil	659	1	Same
	63-1	Resistor	471	Bottom	Valve	42	3	Same
	63-2	Valve	42	3	Same	53	3	Same
10-7-56	63-4	Resistor	471	Bottom	Tube	1	3	Same
45-4-46	64-1	Strip	4	2, top	Capacitor	526	2	Same
46-10-47	65-1	Valve	42	8	Strip	4	6, top	Same
	66-1	Capacitor	566	Bottom	Valve	42	5	Same
46-10-47	66-2	Same	566	Bottom	Strip	4	7, top	Same
	67-1	Same	563	Bottom	Valve	53	5	Same

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1	2	3	4	5	6	7	8	9
47-10-46	67-2	Capacitor	563	Bottom	Strip	4	8, top	МГВСЛ, 0.35 sq.mm
26-9-7-46	68-1	Strip	4	9, top	Capacitor	562		Same
46-10-50	68-2	Same	4	9, top	Strip	6	1, top	Same
46-10-47	69-1	Same	4	10, top	Valve	53	4	Same
1-2-4-10-47	70-1	Valve	53	8	Single-pin plug	777		Same
18; 2; 4; 10; 48	72-1	Resistor	143		Block	5	11, bottom	Same
48-10-49	73-1	Strip	5	9, top	Valve	51	6	Same
	73-2	Same	7	10, bottom	Same	51	3	Same
	73-3	Valve	51	3	Strip	6	2, bottom	Same
	74-1	Same	51	4	Same	7	9, bottom	Same
48-10-49	75-1		7	11, top	Same	5	7, top	Same
48-10-50	75-2	Same	5	7, top	Valve	50	4	Same
	76-1	Valve	51	5	Strip	6	4, bottom	Same
48-10-50	77-1	Strip	6	4, top	Same	5	5, top	Same
48-10-50	77-2	Same	5	5, top	Valve	50	8	Same
	78-1	Valve	49	3	Strip	5	2, bottom	Same
47	78-2	Same	49	3	Capacitor	543	1	Same
47-10-48	79-1	Capacitor	543	2	Strip	5	3, top	Same
18-4-10-48	80-1	Strip	5	1, top	Variable resistor	445	2	Same
21-5-2-18	80-2	Variable resistor	445	2	Capacitor	589		Same
18-4-37-2		Same	445	3	Strip	8	6, top	Same
	83-1	Valve	49	5	Same	5	3, bottom	Same
	84-1	Same	49	6	Same	5	4, bottom	Same
	85-1	Same	49	8	Same	5	6, bottom	Same
49-10-47	86-1	Same	49	4	Same	7	7, top	Same
	87-1	Same	48	3	Same	7	2, bottom	Same
47-10-49	87-2	Strip	7	2, bottom	Capacitor	534	1	Same
47-10-49	88-1	Capacitor	534	2	Strip	7	3, top	Same
	89-1	Valve	48	5	Same	7	3, bottom	Same
21-5-7-10, 49	90-1	Strip	7	4, top	Capacitor	588		Same

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1	2	3	4	5	6	7	8	9
55-2-5-21	90-2	Capacitor	588		Variable resistor	437	2	МГВСЛ, 0.35 sq.mm
	91-1	Variable resistor	437	3	Same	445	1	Same
55-2-4-38	92-1	Same	437	1	Strip	8	10, bottom	Same
	93-1	Valve	48	8	Same	7	6, bottom	Same
48-10-49	94-1	Same	48	6	Same	5	8, top	Same
	95-1	Same	48	4	Same	7	5, bottom	Same
49-10-41	96-1	Strip	7	5, top	Same		4, top	Same
41-10-11-53	96-2	Same	14	4, top	Same	15	4, top	Same
53	96-3	Strip	15	4, top	Valve	40	3-4-5	Same
23-6-5-2-4-37	97-1	Same	9	1, top	Strip	8	1, top	Same
55-2-4-37	97-2	Same	8	1, top	Variable resistor	207	3	Same
	97-3	Variable resistor	207	3	Same	208	3	Same
23-8-24	97-4	Valve	17	4	Capacitor	541		Same
23	97-5	Capacitor	541		Strip	9	1, top	Same
	98-1	Variable resistor	207	1	Variable resistor	208	1	Same
55-2-1	99-1	Same	207	2	Switch	728	4	Same
55-2-5-6-23	99-2	Same	207	2	Capacitor	536		Same
1-2	100-1	Same	208	2	Switch	728	8	Same
23-6-5-2	100-2	Same	208	2	Capacitor	537		Same
	101-1	Strip	9	5, bottom	Valve	15	1	Same
	102-1	Valve	15	3	Same	16	3	Same
	102-2	Same	15	3	Strip	9	7, bottom	Same
23-6-5-2-1	103-1	Strip	9	8, top	Jack	761		Same
23-6-5-2-1	104-1	Same	9	5, top	Switch	728	1-2	Same
	105-1	Valve	15	6	Valve	16	5	Same
	105-2	Same	15	6	Strip	9	9, bottom	Same
23-6-5-2-1	106-1	Strip	9	9, top	Jack	762		Same
	107-1	Valve	15	4	Strip	9	11, bottom	Same
23	108-1	Strip	9	6, top	Switch	726	2,4	Same
	109-1	Switch	726	3	Connector	1223		Same
	110-1	Same	726	1	Same	1079		Same

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1	2	3	4	5	6	7	8	9
23-6-5-2-1	111-1	Strip	9	11, top	Switch	728	5-6	МГВСЛ, 0.35 sq.mm
22-8-7-57	112-1	Valve	16	4	Variable resistor	216	3	Same
22-8	113-1	Same	16	8	Same	217	3	Same
	114-1	Variable resistor	217	1,2	Same	216	1,2	Same
24-7-57	114-2	Same	216	1,2	Valve	17	3,5	Same
24	114-3	Capacitor	540	2	Same	17	5	Same
	114-4	Valve	17	5,3	Strip	9	2, bottom	Same
23-6-5-2-1	115-1	Strip	9	2, top	Strip	17	6, bottom	Same
1	115-2	Same	17	6, bottom	Single-pin plug	763		Same
	116-1	Same	9	3, bottom	Valve	17	6	Same
24	116-2	Valve	17	6	Capacitor	540	1	Same
	117-1	Inductance coil	652	1,2	Strip	9	4, top	Same
	118-1	Strip	9	4, bottom	Valve	17	8	Same
	118-2	Valve	17	8	Capacitor	545	Bottom	Same
	119-1	Capacitor	545	Top	Valve	18	3,4	Same
24-8-9-26	120-1	Valve	18	1,2	Capacitor	542		Same
24-8-6-5-2-18	120-2	Same	18	1,2	Variable resistor	280	2	Same
22-8-24	121-1	Same	18	6	Strip	9	10, bottom	Same
24-7-8-56	121-2	Same	18	6	Tube	1	5	Same
23-6-5-2-1	122-1	Strip	9	10, top	Strip	17	5, bottom	Same
1	122-2	Same	17	5, bottom	Single-pin plug	766		Same
	123-1	Valve	22	3,4,5	Strip	10	8, bottom	Same
26-9-8-6-5-2-1	124-1	Strip	10	8, top	Same	17	4, bottom	Same
1	124-2	Same	17	4,bottom	Single-pin plug	769		Same
	125-1	Valve	22	6	Strip	10	9, bottom	Same
	126-1	Strip	10	9, top	Valve	20	4	Same
	127-1	Same	10	11, bottom	Connector	1081		Same
	128-1	Valve	20	6	Strip	10	10, bottom	Same
25-9-26	128-2	Strip	10	10, bottom	Capacitor	547		Same
	129-1	Valve	21	8	Strip	10	4, top	Same
	129-2	Same	21	8	Valve	20	8	Same

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1	2	3	4	5	6	7	8	9
	130-1	Strip	10	7, bottom	Inductance coil	653	3,4	МГВСЛ,0.35 sq.mm
	131-1	Same	10	6, bottom	Same	653		Same
27-9-26	131-2	Inductance coil	653	1,2	Capacitor	552		Same
27-28	132-1	Valve	23	4	Variable resistor	268	1	Same
28-29	132-2	Strip	11	9, bottom	Same	268	1	Same
25-7-57	133-1	Valve	20	3,5	Variable resistor	243	3	Same
57-7-5-2-1	134-1	Variable resistor	243	2,1	Jack	767		Same
	135-1	Valve	21	6	Strip	10	3, bottom	Same
25-26	135-2	Strip	10	3, bottom	Capacitor	556		Same
25-5	136-1	Valve	21	3,5	Variable resistor	255	3	Same
8-6-5-2-1	137-1	Variable resistor	255	1,2	Jack	768		Same
	138-1	Strip	10	1, bottom	Connector	1046		Same
	139-1	Valve	21	4	Strip	10	2, top	Same
	140-1	Strip	10	2, bottom	Valve	23	3	Same
	141-1	Same	10	5, bottom	Same	23	1,2,6	Same
26-9-8-6-5-2-1	142-1	Same	10	5, top	Strip	17	3, bottom	Same
1	142-2	Same	17	3, bottom	Single-pin plug	770		Same
	143-1	Valve	22	1	Variable resistor	265	1	Same
27-28	143-2	Variable resistor	265	1	Strip	11	11, bottom	Same
	144-1	Same	265	2,3	Valve	24	5	Same
	145-1	Valve	24	3	Variable resistor	268	3,2	Same
	146-1	Same	33	5	Strip	11	5, bottom	Same
	147-1	Same	33	2	Same	11	10, bottom	Same
55-2-5-6-8-9-31	148-1	Strip	11	5, top	Variable resistor	370	1	Same
55-2-5-6-8-9-28	149-1	Variable resistor	370	2	Valve	33	1	Same
55-2-5-7-10-11-53	150-1	Same	370	3	Strip	15	1, top	Same
	151-1	Valve	33	3,6	Same	11	8, bottom	Same
28-9-7-10-40	152-1	Strip	14	4, bottom	Valve	33	4	Same
26-9-32	153-1	Capacitor	560		Same	25	3	Same
32-9-7-10-40	153-2	Valve	25	3	Same			Same
41-10-4-2-18	153-3	Strip	14	3, top	Variable resistor	280	3	Same

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1	2	3	4	5	6	7	8	9
28-32	155-1	Valve	25	6	Strip	11	7, bottom	МГВСЛ, 0.35 sq
32-9-7-56	155-2	Same	25	6	Tube	1	7	Same
31-9-7-5-2-1	156-1	Strip	11	7, top	Strip	17	9, bottom	Same
1	156-2	Same	17	9, bottom	Single-pin plug	771		Same
30-28-9-7-4-58	157-1	Valve	14	3	Adapter	2	4	Same
	157-2	Adapter	2	4	Deflection coil	659	2	Same
9-28-30	158-1	Valve	14	8	Resistor	203	Top	Same
30	159-1	Same	14	4	Strip	11	3, bottom	Same
26-9-28-30	160-1	Same	14	5	Capacitor	532		Same
26-9-8-5-2-18	160-2	Capacitor	532		Variable resistor	201	2	Same
18-4-37	161-2	Variable resistor	201	1	Strip	8	4, top	Same
28-29-9-7-4-58	162-1	Valve	34	3	Adapter	2	2	Same
	162-2	Adapter	2	2	Focusing coil	656	1	Same
	163-1	Valve	34	8	Strip	11	4, bottom	Same
	164-1	Same	34	4	Same	11	2, bottom	Same
26-9-29	165-1	Same	34	5	Capacitor	599		Same
55-2-5-6-8-9-26	165-2	Capacitor	599		Variable resistor	475	2	Same
2-5-7-10-40-55	166-1	Variable resistor	475	1	Strip	14	1, bottom	Same
30	167-1	Valve	46	8	Resistor	425	Top	Same
30-28-9-7-4-58	168-1	Same	46	3	Adapter	2	6	Same
	168-2	Adapter	2	6	Deflection coil	659	5	Same
30	169-1	Valve	46	4	Strip	11	1, bottom	Same
26-9-28-30	170-1	Same	46	5	Capacitor	598		Same
26-9-8-6-5-2-18	170-2	Capacitor	598		Variable resistor	420	2	Same
18-4-37	171-1	Variable resistor	420	1	Strip	8	3, top	Same
17-2-4-37	184-1	Strip	8	5, top	Variable resistor	385	3	Same
17-2-4-38	185-1	Variable resistor	385	2	Strip	8	11, top	Same
38-4-10-11-35-7	185-2	Strip	8	11, top	Capacitor	521		Same
	186-1	Same	8	11, bottom	Same	528	Bottom	МГВСЛЭ, 0.35 sq.
	186-2	Valve	37	4-8	Same	528	Bottom	МГВСЛЭ, 0.35 sq.

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1	2	3	4	5	6	7	8	9
	187-1	Capacitor	528	Top	Valve	38	1	МГВСЛ, 0.35 sq.mm
	187-2	Valve	38		Strip	13	11, bottom	Same
	188-1	Valve	37	3-5	Valve	41	8	
	188-2	Same	41	8	Same	43	1	Same
	188-3	Same	43	1	Strip	13	3, bottom	Same
11-54	188-4	Strip	13	3, bottom	Capacitor	590	2	Same
35-7-10-11	189-1	Same	13	11, top	Same	524		Same
	190-1	Same	13	10, bottom	Valve	38	2	Same
	190-2	Valve	38	2	Capacitor	529	Bottom	Same
	191-1	Capacitor	529	Top	Valve	38	4	Same
	192-1	Valve	38	5	Strip	13	9, bottom	Same
47-10-7-35	192-2	Strip	13	9, bottom	Capacitor	563	Top	Same
	194-1	Valve	41	4	Same	592	Bottom	Same
11	194-2	Strip	13	7, bottom	Valve	41	4	Same
53-11	195-1	Same	15	2, bottom	Same	41	6	Same
26-9-7-10-11	195-2	Valve	41	6	Capacitor	591		Same
3-2-5-7-10-11	196-1	Same	41	3-5	Switch	806		Same
41-10-11	197-1	Strip	14	5, top	Valve	40	1	Same
30-28-9-7-35-36	198-1	Variable resistor	401	3	Capacitor	597	Bottom	Same
11-10-7-35-36	198-2	Valve	40	6	Variable resistor	401	3	Same
35-36	199-1	Variable resistor	401	1-2	Strip	13	3, top	Same
29-28-9-7-5-2-18	200-1	Capacitor	597	Top	Variable resistor	417	2	Same
54-11-10-7-56		Same	590	1	Same	403	3	Same
	202-1	Valve	43	2	Strip	13	5, bottom	Same
	202-2	Same	43	2	Capacitor	594	2	Same
11-54	203-1	Same	43	4	Same	594	1	Same
11-54	203-2	Capacitor	594	1	Valve	44	3	Same
56-7-35	204-1	Strip	13	5, top	Capacitor	593	2	Same
	205-1	Valve	43	3	Strip	13	1, bottom	Same
35-7-10-39	206-1	Strip	13	1, top	Valve	45	8	Same
	206-2	Valve	45	8	Resistor	418	Top	Same

SECRET

 HUM

SECRET

1	2	3	4	5	6	7	8	9
	206-3	Resistor	418	Top	Strip	14	7, bottom	МГВСЛ, 0.35 sq.mm
3-2-5-7-10-11	207-1	Valve	43	6	Strip	16	4, bottom	Same
3	207-2	Strip	16	4, bottom	Single-pin plug	807		Same
	208-1	Valve	43	5	Strip	13	2, botto	Same
11-54	208-2	Same	43	5	Capacitor	595	1	Same
11-54	209-1	Capacitor	595	2	Valve	44	8	Same
	210-1	Valve	44	5	Strip	15	3, bottom	Same
53-11	210-2	Strip	15	3, bottom	Capacitor	572		Same
35	211-1	Same	13	4, top	Valve	45	4	Same
39-10-4-58	212-1	Valve	45	3	Adapter	2	5	Same
	212-2	Adapter	2	5	Deflection coil	659	4	Same
18-2-4-10-41	213-1	Strip	14	7, top	Variable resistor	417	3	Same
18-2-5-7-10-39	214-1	Resistor	418	Bottom	Same	419	3	Same
3-2-18	215-1	Variable resistor	419	1-2	Strip	16	5, bottom	Same
3	215-2	Strip	16	5, bottom	Single-pin plug	808		Same
	216-1	Valve	27	1	Strip	14	8, bottom	Same
17-25-7 10-41	217-1	Strip	14	8, top	Variable resistor	305	2	МГВСЛЭ, 0.35 sq.mm
17-2-4-10	218-1	Variable resistor	305	1	Strip	7	1, bottom	МГВСЛЭ, 0.35 sq.mm
49-10-50	219-1	Capacitor	571		Same	7	1, top	МВГСЛ, 0.35 sq.mm
42-4-10-49	219-2	Strip	7	1, top	Variable resistor	311	2	МГВСЛЭ, 0.35 sq.mm
2-4-42	219-3	Variable resistor	311	2	Adapter	1	1	Same
60	219-4	Adapter	1	1	Selsyn	704	P_2	МГВСЛ, 0.35 sq.mm
42-4-37	220-1	Variable resistor	311	1	Strip	8	9, top	Same
	221-1	Valve	27	3	Same	14	10, bottom	Same
	221-2	Same	27	3	Valve	28	2-6	Same
	221-3	Same	28	2-6	Transformer	654	6	Same
3-2-5-7-10-41	222-1	Strip	14	10, top	Strip	16	11, bottom	Same
3	222-2	Same	16	11, bottom	Single-pin plug	773		Same
	223-1	Valve	27	6	Strip	14	9, bottom	Same
	224-1	Same	27	4	Same	14	11, bottom	Same

SECRET

1	2	3	4	5	6	7	8	9
54-40-10-11	224-2	Strip	14	11, bottom	Capacitor	573	2	МГВСЛЭ, 0.35 sq.
35-7-10-41	225-1	Strip	14	11, top	Transformer	654	1	МГВСЛЭ, 0.35 sq.
3-2-5-7-35	226-1	Transformer	654	2	Single-pin plug	774		МГВСЛ, 0.35 sq.
	227-1	Same	654	3	Capacitor	574	Bottom	Same
	228-1	Capacitor	574	Top	Valve	28	1	Same
	229-1	Transformer	654	4	Same	28	5-3	Same
39-40	229-2	Valve	28	3-5	Strip	14	6, bottom	МГВСЛЭ, 0.35 sq
3-2-5-7-10-41	230-1	Strip	14	6, top	Same	16	1, bottom	МГВСЛ, 0.35 sq
3	230-2	Same	16	1, bottom	Single-pin plug	772		Same
	231-1	Transformer	654	5	Capacitor	575	Bottom	Same
	232-1	Capacitor	575	Top	Valve	28	4	Same
21-5-7-10-52	233-1	Connector	1084	7	Same	47	3	Same
59	234-1	Same	1084	8	Adapter	1	10	Same
60	234-2	Adapter	1	10	Selsyn	705	P_2	Same
60	235-1	Selsyn	705	P_1	Adapter	1	3	Same
21-2	235-2	Adapter	1	3	Valve	47	1	Same
59	236-1	Connector	1085	2	Capacitor	573	2	Same
59	237-1	Same	1085	3	Adapter	1	9	Same
60	237-2	Adapter	1	9	Selsyn	705	C_3	Same
59	238-1	Connector	1085	4	Adapter	1	8	Same
60	238-2	Adapter	1	8	Selsyn	705	C_2	Same
59	239-1	Connector	1085	5	Adapter	1	7	Same
60	239-2	Adapter	1	7	Selsyn	705	C_1	Same
59	240-1	Connector	1085	6	Adapter	1	6	Same
60	240-2	Adapter	1	6	Selsyn	704	C_3	Same
59	241-1	Connector	1085	7	Adapter	1	5	Same
60	241-2	Adapter	1	5	Selsyn	704	C_2	Same
59	242-1	Connector	1085	8	Adapter	1	4	Same
60	242-2	Adapter	1	4	Selsyn	704	C_1	Same
60	243-1	Selsyn	704	P_1	Adapter	1	2	Same

1	2	3	4	5	6	7	8	9
60-2-17	243-2	Adapter	1	2	Variable resistor	305	3	МГВСЛЭ, 0.35 sq.mm
3-2-5-7-10	244-1	Strip	15	5, bottom	Single-pin plug	804	–	МГВСЛ, 0.35 sq.mm
11-53								
3	245-1	Same	16	7, bottom	Same	793	–	Same
3	246-1	Same	16	10, bottom	Same	794	–	Same
	247-1	Valve	25	1,2,4	Strip	10	4, bottom	Same
59	248-1	Terminal	1087	–	Connector	1084	3	Same
59	249-1	Same	1088	–	Same	1084	2	Same
30-28-9-7-56	250-1	Same	1088	–	Tube	1	2	Same
30-28-9-7-56	251-1	Same	1087	–	Same	1	8	Same
11-10-4-2-1	252-1	Same	1088	–	Lighting lamp	87	–	Same
3-2-1-12	254-1	Strip	17	1, top	Switch	727	1	Same
2	255-1	Switch	727	3	Dial lamp	81	–	Same
	255-2	Same	727	3	Same	82	–	Same
	256-3	Valve	81	1	Lighting			Same
20-3-2-5-21	256-1	Same	47	8	Single-pin plug	795		Same
3	256-1	Connector	795		Lighting lamp	87		Same
20-3-2-5-21	257-1	Valve	47	7	Single-pin plug	795		Same
20-3-2-4-43	258-1	Same	10	7	Same	796		Same
20-3-2-4-43	259-1	Same	10	2	Same	796		Same
39-10-7-5-2-3	262-1	Same	28	7	Same	798		Same
39-10-7-5-2-3-20	263-1	Same	28	8	Same	798		Same
43-4-2-3	264-1	Same	5	7	Same	809		Same
	265-1	Resistor	471	Top	Resistor	474	Bottom	Same
18,2,4,10,48	269-1	Same	143	3	Strip	5	9, bottom	Same
37-42	0-100	Strip	8	8, top	Earth			Same
38-4-43	270-1	Same	8	7, bottom	Lighting lamp	5	3	Same

SECRET

WIRE TABLE TO WIRING DIAGRAM OF AZIMUTH-RANGE INDICATOR (UNIT BO-01)
(Figs 23 and 24)

No. of wire bundle	No. of wire	From			To			Type and cross-section of wire
		Part	Ref. No. in key diagram	No. of contact	Part	Ref. No. in key diagram	No. of contact	
1	2	3	4	5	6	7	8	9
	a-1	Terminal	1048, 1049		Valve	30	2,7	МГВСЛ, 2 sq.mm
	a-2	Valve	30	2,7	Same	31	2,7	Same
	a-3	Same	31	2,7	Same	27	7,8	Same
	a-5	Terminal	1048, 1049		Same	25	7,8	Same
	a-6	Valve	21	2,7	Same	25	7,8	Same
	a-7	Same	21	2,7	Same	19	2,7	Same
	a-8	Same	19	2,7	Same	20	2,7	Same
	a-10	Terminal	1048, 1049		Same	18	7,8	Same
	a-11	Valve	18	7,8	Same	16	2,7	Same
	a-12	Same	16	2,7	Same	17	2,7	Same
	a-13	Same	17	2,7	Same	15	7,8	Same
	a-15	Terminal	1048, 1049		Same	51	2,7	Same
	a-16	Valve	51	2,7	Same	50	2,7	Same
	a-17	Same	50	2,7	Same	42	2,7	Same
	a-18	Same	42	2,7	Same	34	2,7	Same
	a-20	Terminal	1048, 1049		Same	14	2,7	Same

SECRET

1	2	3	4	5	6	7	8	9
	a-23	Terminal	1048, 1049		Valve	11	7,8	МГВСЛ, 2 sq.mm
	a-24	Valve	11	8,7	Same	12	2,7	Same
	a-25	Same	12	2,7	Same	13	2,7	Same
	a-27	Terminal	1048, 1049		Same	9	2,7	Same
	a-28	Valve	9	2,7	Same	6	2,7	Same
	a-29	Same	6	2,7	Same	4	2,7	Same
	a-30	Same	4	2,7	Same	2	2,7	Same
	b-1	Connector	1035	2,3	Same	3	7,8	МГВСЛ, 1 sq.mm
	c-1	Same	1035	4,5	Same	10	2,7	Same
	d-1	Same	1035	6,7	Same	48	2,7	Same
	d-2	Valve	48	2,7	Same	49	2,7	Same
	d-3	Same	49	2,7	Same	29	7,8	Same
	d-4	Same	29	7,8	Same	28	7,8	Same
	f-1	Connector	1035	8,9	Same	5	7,8	Same
	a-4	Valve	27	7,8	Tube	1	2,8	Same
44, 6	0-1	Resistor	349	Top	Strip (terminal)	11	1, bottom	МГВСЛ, 0.35 sq.mm
33, 1, 2, 5, 36	0-2	Strip (terminal)	6	3, bottom	Same	7	6, top	Same
32, 34, 18	0-4	Same	5	4, bottom	Resistor	179	1	Same
32, 3, 4	0-5	Same	5	4, bottom	Capacitor	526	1	Same
10, 13, 48	0-6	Single-pin plug	794	Short	Recess board	Bottom	Earth lug	Same
9, 1, 33	0-7	Switch	718	1	Strip	6	3, bottom	Same
47, 9	0-8	Single-pin plug	774	Short	Switch	728	4	Same
	0-40	Resistor	125	2	Resistor	125	3	ММ, 1 mm dia.
	0-41	Same	125	2	Earth			МГВСЛ, 0.35 sq.mm
	0-42	Strip	1	7, bottom	Same			Same
	0-43	Valve	4	1	Valve	4	8	ММ, 1 mm dia.

1	2	3	4	5	6	7	8	9
	0-44	Valve	4	1	Earth			ММ,
	0-45	Same	6	1	Valve	6	8	Same
	0-46	Same	6	8	Earth			Same
	0-47	Same	9	1	Same			Same
	0-48	Same	10	1	Same			Same
	0-49	Strip	3	4, bottom	Same			МГВСЛ, 0.35 sq.mm
	0-50	Valve	12	1	Same			ММ, 1 mm dia.
	0-51	Same	13	1	Same			Same
	0-52	Same	14	1	Same			Same
	0-55	Resistor	203	Top	Same			МГВСЛ, 0.35 sq.mm
	0-56	Capacitor	526					ММ, 1 mm dia.
	0-57	Strip	4	10, bottom	Same			МГВСЛ, 0.35 sq.mm
	0-58	Valve	34	1	Same			ММ, 1 mm dia.
	0-60	Same	42	1	Same			Same
	0-61	Connector	1035	11	Same			МГВСЛ, 0.35 sq.mm
	0-62	Same	1034	1	Same			Same
	0-63	Valve	50	1	Same			ММ, 1 mm dia.
	0-64	Same	50	1	Valve	50	3	Same
	0-65	Same	50	3	Same	50	5	Same
	0-66	Same	48	1	Earth			Same
	0-67	Same	51	1	Same			Same
	0-68	Same	51	1	Valve	51	8	Same
	0-69	Same	49		Earth			Same
	0-70	Strip	12	8, bottom	Same			МГВСЛ, 0.35 sq.mm
	0-71	Same	11	7, bottom	Same			Same
	0-72	Valve	31	1	Same			ММ, 1 mm dia.
	0-73	Same	30	1	Same			Same

1	2	3	4	5	6	7	8	9
	0-74	Strip	10	4, bottom	Earth			МГВСЛ, 0.35 sq.mm
	0-75	Valve	21	1	Same			ММ, 1 mm dia.
	0-77	Same	19	1	Same			Same
	0-78	Same	20	1	Same			Same
	0-79	Strip	8	5, bottom	Same			МГВСЛ, 0.35 sq.mm
	0-80	Valve	16	1	Same			ММ, 1 mm dia.
	0-81	Same	17	1	Same			Same
	0-82	Strip	7	5, bottom	Same			МГВСЛ, 0.35 sq.mm
	0-83	Capacitor	551, 560	Earth lug	Same			ММ, 1 mm dia.
	0-85	Resistor	355	3	Resistor	475	1	Same
	0-86	Same	475	1	Same	201	3	МГВСЛ, 0.35 sq.mm
	0-87	Same	201	3	Earth			Same
	0-88	Resistor	179	1	Resistor	179	2	ММ, 1 mm dia.
	0-89	Same	179	2	Same	180	1	МГВСЛ, 0.35 sq.mm
	0-90	Same	180	1	Same	180	2	ММ, 1 mm dia.
	0-91	Switch	718	1	Switch	720	1	МГВСЛ, 0.35 sq.mm
	0-92	Same	720	1	Same	719	1	Same
	0-93	Same	719	1	Same	728	8	Same
	0-94	Same	728	8	Same	728	4	ММ, 1 mm dia.
	0-95	Capacitor	588, 589	Earth lug	Earth			МГВСЛ, 0.35 sq.mm
	0-96	Strip	9	2, bottom	Same			Same
4, 25	1-1	Connector	1035	13	Strip	4	2, top	Same
25, 4	1-2	Strip	4	2,top	Resistor	471	Bottom	Same
4, 23	1-3	Resistor	471	Bottom	Strip	3	2, top	Same

1	2	3	4	5	6	7	8	9
23, 4, 3, 31	1-4	Strip	3	10, top	Strip	5	6, top	МГВСЛ, 0.35 sq.mm
31, 4, 3, 22	1-5	Same	5	6, top	Valve	10	5	Same
21, 4, 22	1-6	Same	2	2, top	Same		5	Same
21, 17	1-7	Same	2	2, top	Same	5	5	Same
17, 16, 15	1-8	Valve	5	5	Strip	1	1, top	Same
15, 16, 13, 14	1-9	Strip	1	1, top	Resistor	123	1	Same
14, 13, 10, 48	1-10	Resistor	123	1	Single-pin plug	756	Short	Same
18, 21	1-12	Same	154	3	Strip	2	11, top	Same
25, 4, 27	1-13	Strip	4	7, top	Same	13	2, top	Same
27, 4, 3, 7, 28	1-14	Same	13	10, top	Same	12	10, top	Same
28, 7	1-15	Same	12	10, top	Valve	27	2	Same
43, 6, 3, 7	1-16	Same	10	2, top	Same	27	2	Same
43, 6, 39, 40	1-17	Same	10	2, top	Same	25	5	Same
40, 39, 3, 2, 5, 38	1-18	Valve	25	5	Strip	8	8, top	Same
38	1-19	Strip	8	8, top	Valve	18	5	Same
33, 5	1-20	Valve	18	5	Inductance coil	652	2	Same
36, 5	1-21	Strip	7	3, top	Same	652	2	Same
36, 5, 2, 1, 34	1-22	Strip	7	3, top	Strip	6	2, top	МГВСЛ, 0.35 sq.mm
34, 35	1-23	Valve	15	2	Same	6	2, top	Same
	1-24	Strip	13	8, top	Valve	29	2	Same
	1-25	Same	5	2, top	Adapter	II	2	Same
	1-26	Resistor	123	1	Resistor	123	2	ММ, 1 mm dia.
	1-27	Same	123	2	Valve	3	2	МГВСЛ, 0.35 sq.mm
	1-28	Valve	10	3	Same	10	5	ММ, 1 mm dia.

1	2	3	4	5	6	7	8	9
	1-29	Valve	27	2	Valve	27	5	ММ, 1 mm dia.
	1-30	Same	25	5	Strip	9	3, bottom	МГВСЛ, 0.35 sq.mm
	1-31	Inductance coil	652	1	Inductance coil	652	1	ММ, 1 mm dia.
	1-32	Valve	15	2	Valve	15	[illegible]	Same
	1-33	Resistor	154	3	Resistor	154	2	Same
	1-34	Same	154	2	Same	153	2	МГВСЛ, 0.35 sq.mm
		Same	153	2	Same	153	3	ММ, 1 mm dia.
4, 25	2-1	Connector	1035	1	Strip	4	4, bottom	МГВСЛ, 0.35 sq.mm
25, 4, 23	2-2	Strip	4	4, bottom	Same	3	3, top	Same
31, 3, 23	2-3	Same	5	11, top	Same	3	3, top	Same
31, 3, 4, 21	2-4	Same	5	11, top	Same	2	4, top	Same
21, 4, 27	2-5	Same	2	4, top	Same	13	1, top	Same
27, 4, 3, 6, 41	2-6	Same	13	5, top	Same	9	9, top	Same
41, 6, 3, 2, 5, 38	2-7	Same	9	9, top	Same	8	7, top	Same
38, 5, 2, 1, 33	2-8	Same	8	7, top	Same	6	5, bottom	Same
33, 1, 11	2-9	Same	6	5, bottom	Resistor	280	1	Same
33, 1, 9, 47	2-10	Same	6	11, bottom	Single-pin plug	766	Short	Same
	3-1	Connector	1023		Tube	1	High voltage lead-out	ПВЛ-1
	5-1	Resistor	123	3	Resistor	124	1	МГВСЛ, 0.35 sq.mm
	6-1	Same	125	1	Same	124	3	Same
13, 16, 15	7-1	Same	124	2	Strip	1	8, top	Same
15, 16, 17	7-2	Strip	1	9, top	Capacitor	502		Same
15, 16, 13, 14	8-1	Same	1	3, top	Valve	2	8	Same

1	2	3	4	5	6	7	8	9
15, 16, 10	9-1	Strip	1	6, top	Single-pin plug	752	Long	МГВСЛ, 0.35 sq.mm
15, 16, 10	10-1	Same	1	11, top	Same	753	Long	Same
49, 17	11-1	Valve	4	3	Blocking transformer	651	6	Same
49, 17, 4, 3, 32	12-1	Blocking transformer	551	4	Strip	5	7, bottom	Same
49, 17, 16	13-1	Same	651	2	Valve	4	6	Same
17, 4, 3, 32	14-1	Same	651	5	Strip	5	6, bottom	Same
17, 16	15-1	Same	651	3	Valve	4	5	Same
17, 21	16-1	Same	651	1	Strip	2	3, top	Same
25, 4, 17, 16, 10	17-1	Strip	4	3, bottom	Single-pin plug	754	Long	Same
17, 4, 3, 32	18-1	Same	5	6	Strip	5	3, bottom	Same
32, 3, 4, 22	18-2	Same	5	3, bottom	Capacitor	517	Top	Same
22, 4, 26	18-3	Capacitor	517	Top	Same	566	Top	Same
17, 4, 3, 32	19-1	Valve	5	8	Strip	5	1, bottom	Same
32, 3, 21, 10	19-2	Strip	5	1, bottom	Single-pin plug	809	Long	Same
21, 4, 3, 32	20-1	Same		6, top	Strip	5	2, bottom	Same
32, 3, 2, 1, 10	20-2	Same	5	2, bottom	Single-pin plug	756	Long	Same
21, 4, 3, 2, 1, 12	21-1	Same	2	9, top	Resistor	143	2	Same
22, 4, 18, 19	22-1	Valve	9	3	Switch	724	II (3)	Same
	22-2	Same	9	3	Valve	11	1	Same
22, 4, 23	23-1	Capacitor	517	Bottom	Strip	3	1, top	Same
	23-2	Valve	9	4	Capacitor	517	Bottom	Same
22	24-1		9	6	Same	530	1	Same
22	24-2	Same	9	6	Valve	11	5	Same
	24-3	Same	11	5	Strip	3	10, bottom	Same
22, 4, 3, 2, 1, 10	25-1	Same	9	8	Single-pin plug	758	Long	Same
22, 4, 18,	26-1	Valve	10	8	Strip	5	10, bottom	Same

1	2	3	4	5	6	7	8	9
	26-2	Resistor	177	2	Resistor	177	1	MM, 1 mm dia.
	26-4	Same	175	1	Same	175	2	Same
	26-5	Valve	10	4	Valve	10	8	Same
	26-6	Same	10	4	Capacitor	525	Top	МГВСЛ, 0.35 sq.mm
22, 4, 23	27-1	Capacitor	525	Bottom	Strip	3	8, top	Same
23, 4	27-2	Strip	3	8, top	Resistor	196	Bottom	Same
24, 4	27-3	Resistor	196	Bottom	Valve	13	8	Same
22	28-1	Valve	11	2	Capacitor	527	1	Same
	28-2	Same	11	2	Strip	3	6, bottom	Same
22	29-1	Same	11	4	Capacitor	527	2	Same
		Strip	3	11, bottom	Single-pin plug	759	Long	Same
1,10,22,4,3,2	30-1	Same	3	11, bottom	Valve	11	6	Same
	30-2	Same	3	4, top	Resistor	208	1	Same
23,4,3,2,1,12	31-1	Resistor	207	1	Same	208	1	Same
	31-2	Strip	3	5, top	Same	201	1	Same
23,4,3,2,1,12	32-1	Same	3	6, top	Capacitor	526	2	Same
23,4	33-1							
4,3,2,1,12	34-1	Resistor	196	Top	Resistor	197	3	Same
24, 4, 22	35-1	Valve	12	8	Capacitor	530	2	Same
	35-2	Same	12	4	Valve	12	8	MM, 1 mm dia.
24, 4, 26	36-1	Same	12	3	Capacitor	531	-	МГВСЛ, 0.35 sq.mm
	36-2	Same	12	3	Valve	12	5	MM, 1 mm dia.
	36-3	Same	12	5	Strip	3	3, bottom	МГВСЛ, 0.35 sq.mm
24, 4, 20	37-1	Same	13	3	Adapter	II	4	Same
24, 4, 20	38-1	Same	14	3	Same	II	3	Same
24,4,3,2,1,12	39-1	Same	14	5	Resistor	201	2	Same
24	39-2	Same	14	5	Capacitor	532	-	Same
26, 4, 3, 29	40-1	Same	42	3	Tube	1	3	Same
	40-3	Same	42	3	Resistor	474	Bottom	Same
27, 4, 17, 16, 12	41-1	Resistor	143	3	Strip	13	3, top	Same

SECRET

1	2	3	4	5	6	7	8	9
24, 4	42-1		14	8	Resistor	203	Bottom	МГВСЛ, 0.35 sq.mm
26, 25	43-1	Same	42	8	Strip	4	4, top	Same
26, 4, 25	44-1	Valve	42	5	Strip	4	5, top	Same
	44-2	Same	42	5	Capacitor	566	Bottom	Same
26, 4, 20	45-1	Same	34	3	Adapter	II	1	Same
26. 4. 25	46-1	Same	34	4	Strip	4	8, top	Same
	47-1	Same	34	5	Resistor	475	2	Same
	47-2	Same	34	5	Capacitor	599	–	Same
25, 4, 18	48-1	Strip	4	9, top	Resistor	136	3	Same
25, 4, 18	49-1	Same	4	1, top	Same	136	1	Same
25, 4, 3, 8	50-1	Same	4	6, top	Valve	49	8	Same
25, 4, 26	51-1	Same	4	10, top	Same	34	8	Same
	52-1	Same	4	11, top	Resistor	437	1	Same
	53-1	Same	5	1, top	Same	208	3	Same
11, 1, 2, 5, 36	53-2	Resistor	207	3	Strip	7	1, top	Same
36, 5	53-3	Strip	7	1, top	Valve	17	4	Same
5	53-4	Valve	17	4	Capacitor	541	–	Same
	53-5	Resistor	207	3	Resistor	208	3	Same
31, 3, [illegible], 1, 10	54-1	Strip	5	4, top	Single-pin plug	755	Long	Same
31, 3, [illegible], 1, 12	55-1	Same	5	5, top	Resistor	143	1	Same
31, 3, 4, 17	56-1	Same	5	7, top	Capacitor	507	–	Same
31, 3, 4, 18	56-2	Same	5	7, top	Resistor	136	2	Same
31, 3, 4, 18	57-1	Same	5	9, top	Same	175	1	Same
31, 3, 4, 18	58-1	Same	5	10, top	Same	177	2	Same
18, 19	59-1	Resistor	175	3	Capacitor	522	1	Same
	59-2	Capacitor	522	1	Switch	724	II (2)	Same
18, 19	60-1	Resistor	177	3	Capacitor	523	1	Same
	60-2	Capacitor	523	1	Switch	724	II (1)	Same

SECRET

1	2	3	4	5	6	7	8	9
[illegible]	61-1	Strip	5	11, bottom	Resistor	475	3	MTBCI, 0.35 sq.mm
[illegible]	62-1	Same	2	1, top	Switch	724	1 (3)	Same
[illegible]	63-1	Resistor	197	[illegible]	Single-pin plug	750	Long	Same
	63-2	Same	197	2	Resistor	197	1	MK, 1 mm dia.
[illegible]	64-1	Inductance coil	653	4	Capacitor	552	–	MTBCI, 0.35 sq.mm
	64-2	Same	653	4	Inductance coil	653	1	MK, 1 mm dia.
	64-3	Same	653	4	Strip	8	8, bottom	MTBCI, 0.35 sq.mm
[illegible]	65-1	Resistor	179	3	Capacitor	522	2	Same
[illegible]	66-1	Same	180	3	Same	523	2	Same
[illegible]	67-1		7	11, top	Single-pin plug	761	Long	Same
[illegible]	68-1	Same	7	9, top	Switch	728	1	Same
	68-2	Switch	728	1	Same	728	2	MK, 1 mm dia.
[illegible]	69-1	Strip	7	8, top	Same	728	5	MTBCI, 0.35 sq.mm
	69-2	Switch	728	5	Same	728	6	MK, 1 mm dia.
[illegible]	70-1	Strip	7	7, top	Single-pin plug	762	Long	MTBCI, 0.35 sq.mm
[illegible]	71-1	Same	7	5, top	Same	763	Long	Same
[illegible]	72-1	Valve	1[illegible]	4	Resistor	216	3	Same
[illegible]	73-1	Same	[illegible]	8	Same	217	3	Same
[illegible]	74-1	Same	1[illegible]	3	Capacitor	540	1	Same
	74-2	Same	17	3	Valve	17	5	MK, 1 mm dia.
	74-3	Same	17	5	Strip	7	4, bottom	MTBCI, 0.35 sq.mm
	74-4	Strip	7	4, bottom	Resistor	217	2	Same
	74-5	Resistor	217	2	Same	217	1	MK, 1 mm dia.
	74-6	Same	217	1	Same	216	2	MTBCI, 0.35 sq.mm
	74-7	Same	216	2	Same	216	1	MK, 1 mm dia.
[illegible]	75-1	Valve	17	6	Capacitor	540	2	MTBCI, 0.35 sq.mm

1	2	3	4	5	6	7	8	9
	75-2	Valve	17	6	Strip	7	3, bottom	МГВСЛ, 0.35 sq.mm
5, 2, 3, 39	76-1	Same	18	1	Capacitor	542	-	Same
5, 2, 1, 11	76-2	Same	18	1	Resistor	280	2	Same
	76-3	Same	18	1	Valve	18	2	ММ, 1 mm dia.
38	77-1	Valve	18	6	Strip	8	4, top	МГВСЛ, 0.35 sq.mm
38, 5, 2, 3, 29	77-2	Strip	8	4, top	Tube	1	5	Same
38, 5, 2, 1, 34	78-1	Strip	8	4, bottom	Strip	6	11, top	Same
34, 9	78-2	Same	6	11, top	Single-pin plug	766	Long	Same
38, 5, 2, 3, 39	79-1	Same	8	6, top	Capacitor	550	-	Same
38, 5, 2, 1, 9	80-1	Same	8	5, top	Switch	718	3	Same
38, 5, 2, 1, 34	81-1	Same	8	2, top	Strip	6	8, top	Same
38, 5, 2, 3, 39	81-2	Same	8	2, top	Capacitor	558	-	Same
38, 5, 2, 3, 39	82-1	Same	8	1, top	Valve	19	6	Same
38, 5	82-2	Same	8	1, top	Capacitor	547	-	Same
39, 6, 50	83-1	Valve	19	5	Resistor	243	3	Same
	83-2	Same	19	3	Valve	19	5	ММ, 1 mm dia.
39, 6, 50	84-1	Same	20	5	Resistor	255	3	МГВСЛ, 0.35 sq.mm
	84-2	Same	20	3	Valve	20	5	ММ, 1 mm dia.
39, 6, 41	85-1	Same	20	6	Strip	9	5, top	МГВСЛ, 0.35 sq.mm
41, 6, 39	85-2	Strip	9	5, top	Capacitor	556	-	Same
40, 39, 6, 3, 29	86-1	Valve	25	6	Tube	1	7	Same

1	2	3	4	5	6	7	8	9
	86-2	Valve	25	6	Strip	9	4, bottom	МГВСЛ, 0.35 sq.mm
40, 39, 6, 50	87-1	Same	21	3	Resistor	465	3	Same
	87-2	Same	21	3	Valve	21	5	ММ, 1 mm dia.
40, 39, 6, 41	88-1	Same	21	6	Strip	9	6, top	МГВСЛ, 0.35 sq.mm
41, 6, 39	88-2	Strip	9	6, top	Capacitor	557	-	Same
41, 6, 3, 2, 1, 9	89-1	Same	9	8, top	Switch	720	3	Same
41, 6, 3, 2, 1, 11	90-1	Same	9	2, top	Resistor	280	3	Same
	90-2	Same	9	2, top	Valve	25	3	Same
41, 6, 3, 2, 5, 38	90-3	Same	9	3, top	Capacitor	560		Same
41, 6, 3, 21, 9	92-1	Same	9	4, top	Single-pin plug	771	Long	Same
41, 6, 3, 2, 5, 38	93-1	Same	9	10, top	Capacitor	551		Same
42, 6, 3, 4, 20	94-1	Valve	30	3	Adapter	II	6	Same
42, 6, 3, 2, 1, 9	95-1	Same	30	8	Single-pin plug	775	Long	Same
	95-2	Same	30	8	Strip	10	1, bottom	Same
42, 6, 3, 4, 20	96-1	Same	31	3	Adapter	II	5	МГВСЛ, 0.35 sq.mm
42, 6, 3, 21, 9	97-1	Same	31	8	Single-pin plug	776	Long	Same
	97-2	Same	31	8	Strip	10	10, bottom	Same
9, 47	98-1	Strip	10	1, top	Single-pin plug	775	Short	Same
43, 44	98-2	Same	10	1, top	Resistor	352	Top	Same
43, 6, 3, 7, 28	99-1	Same	10	3, top	Strip	12	3, top	Same

1	2	3	4	5	6	7	8	9
43, 6, 3, 2, 1, 34	100-1	Strip	10	4, top	Strip	6	1, top	МГВСЛ, 0.35 sq.mm
34, 35	100-2	Same	6	1, top	Adapter	I	5	МГВСЛЭ, 0.35 sq.mm
43, 6, 3, 4, 26	100-3	Same	10	5, top	Capacitor	571		Same
46	100-4	Adapter	1	5	Selsyn	704	P2	МГВСЛ, 0.35 sq.mm
43, 6, 3, 2, 1, 11	101-1	Strip	10	6, top	Resistor	308	2	Same
43, 6, 3, 2, 1, 12	102-1	Same	10	7, top	Same	355	2	Same
43, 44	103-1	Same	10	10, top	Same	352	Bottom	Same
43, 6, 2, 3, 1, 9, 47	103-2	Same	10	10, top	Single-pin plug	776	Short	Same
	103-3	Resistor	352	Bottom	Resistor	349	Bottom	Same
43, 6, 3, 2, 1, 12	104-1	Strip	10	11, top	Same	355	1	Same
7	105-1	Valve	27	3	Transformer	654	6	Same
7, 3, 6, 30	105-2	Same	27	3	Strip	11	6, top	Same
30, 6, 3, 7	105-3	Strip	11	6, top	Valve	28	2	Same
	105-4	Valve	28	2	Same	28	6	ММ, 1 mm dia.
7, 3, 6, 44	106-1	Same	27	4	Capacitor	573	2	МГВСЛЭ, 0.35 sq.mm
	106-2	Same	27	4	Strip	11	2, bottom	Same
45	107-1	Connector	1034	2	Capacitor	573	1	Same
	108-1	Valve	28	3	Transformer	654	4	Same
	108-2	Same	28	3	Valve	28	5	ММ, 1 mm dia.
	108-3	Same	28	5	Strip	11	9, bottom	МГВСЛ, 0.35 sq.mm
7, 2, 1, 11	109-1	Same	28	8	Resistor	308	1	Same
	109-2	Same	28	8	Strip	11	11, bottom	Same
7, 2, 1, 10	109-3	Strip	11	11, bottom	Single-pin plug	793	Long	Same
30, 3, 6, 7	110-1	Same	11	1, top	Transformer	654	1	Same

1	2	3	4	5	6	7	8	9
30, 6, 3, 2, 1, 9	110-2	Single-pin plug	774	Long	Strip	11	1, top	МГВСЛ, 0.35 sq.mm
30, 6, 3, 7	111-1	Strip	11	3, top	Transformer	654	2	МГВСЛЭ, 0.35 sq.mm
30, 6, 3, 2, 1, 11	112-1	Same	11	4, top	Resistor	305	2	Same
30, 6, 3, 2, 1, 9	113-1	Same	11	5, top	Single-pin plug	773	Long	МГВСЛ, 0.35 sq.mm
30, 6, 3, 2, 1, 9	114-1	Same	11	7, top	Same	772	Long	Same
30, 6, 3, 8	115-1	Same	11	9, top	Valve	29		Same
28, 7, 2, 1, 51	116-1	Same	12	1, top	Capacitor	588	-	Same
51, 1, 2, 5, 36, 37	116-2	Capacitor	588	-	Resistor	437	2	Same
28, 7, 3, 8	117-1	Strip	12	2, top	Valve	48	5	Same
28, 7, 3, 4, 27	118-1	Same	12	4, top	Strip	13	7, top	Same
27, 4, 3, 8	118-2	Same	13	7, top	Valve	50	8	Same
28, 7, 3, 8	119-1	Same	12	5, top	Capacitor	543	2	Same
8	119-2	Valve	49	3	Same	543	2	Same
28, 7, 3, 8	120-1	Strip	12	6, top	Same	543	1	Same
28, 7, 2, 1, 51	121-1	Same	12	7, top	Same	589	-	Same
51, 1, 11	121-2	Capacitor	589	-	Resistor	445	2	Same
28, 7, 3, 8	122-1	Strip	12	9, top	Valve	48	4	Same
28, 7, 2, 1, 11	123-1	Same	12	11, top	Resistor	308	3	Same
28, 7, 3, 8	124-1	Same	12	1, bottom	Capacitor	534	2	Same
8, 3, 4, 27	125-1	Valve	48	8	Strip	13	6, top	Same
8, 3, 4, 27	126-1	Same	50	4	Same	13	9, top	Same
27, 4, 3, 2, 1, 11	127-1	Strip	13	11, top	Resistor	445	3	Same

1	2	3	4	5	6	7	8	9
33, 11	128-1	Strip	6	1, bottom	Resistor	305	1	МГВСЛЭ, 0.35 sq.mm
34, 1, 10	129-1	Same	6	3, top	Single-pin plug	793	Long	Same
34, 1, 10	130-1	Same	6	4, top	Same	794	Long	МГВСЛ, 0.35 sq.mm
34, 9	131-1	Same	6	6, top	Same	769	Long	Same
34, 1, 2, 3, 50	131-2	Same	6	6, top	Resistor	465	2	Same
	131-3	Resistor	465	2	Same	465	1	ММ, 1 mm dia.
34, 9		Strip	6	7, top	Single-pin plug	768	Long	МГВСЛ, 0.35 sq.mm
34, 1, 2, 3, 50	132-2	Strip	6	7, top	Resistor	255	2	Same
	132-3	Resistor	255	1	Same	255	2	ММ. 1 mm dia.
34, 9	133-1	Strip	6	9, top	Switch	719	3	
34, 9	134-1	Same	6	10, top	Single-pin plug	767	Long	Same
34, 1, 2, 3, 50	134-2	Same	6	10, top	Resistor	243	1	Same
	134-3	Bosistor	243	1	Same	243	2	ММ, 1 mm dia.
5, 2, 1, 11	135-1	Capacitor	536	-	Same	207	2	МГВСЛ, 0.35 sq.mm
5, 2, 1, 9	135-2	Same	536	-	Switch	728	3	Same
5, 2, 1, 12	136-1	Same	537	-	Resistor	208	2	Same
5, 2, 1, 9	136-2	Same	537	-	Switch	728	7	Same
45	137-1	Connector	1034	6	Adapter	I	1	Same
46	137-2	Adapter	I	1	Selsyn	704	C_2	Same
45	138-1	Connector	1034	7	Adapter	I	2	Same
46	138-2	Adapter	I	2	Selsyn	704	C_1	Same
45	139-1	Connector	1034	8	Adapter	I	3	Same
46	139-2	Adapter	I	3	Selsyn	704	C_3	Same
1, 11, 35	140-1	Resistor	305	3	Adapter	I	4	МГСЛЭ, 0.35 sq.mm

1	2	3	4	5	6	7	8	9
46	140-2	Adapter	I	4	Selsyn	704	P_1	МГВСЛ, 0.35 sq.mm
45, 4, 3, 2, 1, 9	141-1	Connector	1034	3	Switch	719	7	МГВСЛЭ, 0.35 sq.mm
45, 4, 3, 2, 1, 9	142-1	Same	1034	4	Same	719	5	Same
	143-1	Capacitor	574	Top	Transformer	654	3	МГВСЛ, 0.35 sq.mm
	144-1	Same	575	Top	Same	654	5	Same
14, 13, 10	145-1	Valve	2	2	Single-pin plug	795	Long	Same
14, 13, 10, 48	146-1	Same	2	7	Same	795	Short	Same
14, 13, 10	147-1	Same	3	7	Same	796	Long	Same
17, 13, 10, 48	148-1	Same	3	8	Same	796	Short	Same
	149-1	Same	10	2	Same	797	Long	Same
	148-2	Same	3	8	Strip	1	9, bottom	Same
	149-2	Same	10	2	Same	3		Same
22, 4, 3, 2, 1, 10, 48	150-1	Valve	10	7	Single-pin plug	797	Short	МГВСЛ, 0.35 sq.mm
7, 2, 1, 10, 48	152-1	Same	28	7	Same	798	Short	Same
17, 16, 10, 48	153-1	Same	5	7	Same	809	Short	Same
44, 6, 3, 31	155-1	Same	27	8	Strip	5	8, top	Same
31, 3, 2, 1, 10	155-2	Strip	5	8, top	Lighting lamp	84	–	Same
10, 1, 9	155-3	Lighting lamp	84	–	Same	83	–	Same
9, 1, 13	156-1	Switch	727	3	Same	82	–	Same
	156-2	Lighting lamp		–	Switch	727	3	Same
32, 3, 2, 1, 9	157-1	Strip	5	8, bottom	Same	727	1	Same
	160-1	Valve	2	1	Valve	2	6	ММ, 1 mm dia.
	160-2	Same	2	1	Strip	1	6, bottom	МГВСЛ, 0.35 sq.mm

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 50X1 HUM

2	3	4	5	6	[illegible]	8	9
161-1	Valve	2	3	Valve	3	5	MTBCJ, 0.35 sq.mm
161-2	Same	2	3	Strip	1	1, bottom	Same
161-3	Same	3	5	Valve	3	4	MK, 1 mm dia.
161-4	Same	3	4	Same	3	1	Same
162-1	Same	2	4	Strip	1	2, bottom	MTBCJ, 0.35 sq.mm
163-1	Same	2	5	Same	1	4, bottom	Same
164-1	Same	3	3	Same	1	10, bottom	Same
165-1	Same	3	6	Same	1	8, bottom	Same
165-2	Strip	1	8, bottom	Same	2	10, bottom	Same
166-1	Valve	4	4	Same	1	5, bottom	Same
167-1	Same	5	1	Same	2	9, bottom	Same
168-1	Same	5	2	Switch	721	3	Same
168-2	Switch	721	3	Same	721	4	MK, 1 mm dia.
169-1	Valve	5	4	Capacitor	511	Top	MTBCJ, 0.35 sq.mm
170-1	Same	6	3	Strip	2	3, bottom	Same
170-2	Same	6	3	Capacitor	511	Bottom	Same
170-3	Capacitor	511	Bottom	Switch	721	2	Same
171-1	Valve	6	4	Strip	2	4, bottom	MTBCJ, 0.35 sq.mm
172-1	Same	6	5	Same	2	1, bottom	Same
173-1	Same	6	6	Same	2	6, bottom	Same
174-1	Strip	2	7, bottom	Through contact			Same
175-1	Same	2	11, bottom	Switch	721	1	Same
178-1	Valve	11	3	Strip	3	8, bottom	Same
180-1	Same	13	4	Same	3	9, bottom	Same
181-1	Same	14	4	Same	4	7, bottom	Same
183-1	Same	48	3	Same	13	10, bottom	Same
183-2	Same	48	3	Capacitor	534	1	Same
184-1	Same	48	6	Strip	13	8, bottom	Same
185-1	Same	51	3	Same	13	4, bottom	Same
186-1	Same	51	4	Same	13	5, bottom	Same

2	3	4	5	6	7	8	9
187-1	Valve	51	5	Strip	13	1, bottom	МГВСЛ, 0.35 sq.mm
188-1	Same	51	6	Same	13	2, bottom	Same
189-1	Same	49	4	Same	12	3, bottom	Same
190-1	Same	49	5	Same	12	6, bottom	Same
191-1	Same	49	6	Same	12	4, bottom	Same
192-1	Same	29	3	Same	12	9, bottom	Same
193-1	Same	28	1	Capacitor	574	Bottom	Same
194-1	Same	28	4	Same	575	Bottom	Same
195-1	Same	27	1	Strip	11	4, bottom	Same
196-1	Same	27	6	Same	11	3, bottom	Same
197-1	Same	31	4	Valve	30	4	Same
197-2	Same	30	4	Strip	10	2, bottom	Same
198-1	Same	31	5	Same	10	9, bottom	Same
199-1	Same	30	5	Same	10	3, bottom	Same
200-1	Same	21	4	Same	9	10, bottom	Same
201-1	Same	21	8	Valve	20	8	Same
201-2	Same	20	8	Valve	19	8	Same
201-3	Same	19	8	Strip	8	10, bottom	Same
202-1	Capacitor	555	Bottom	Through contact			Same
203-1	Same	555	Top	Strip	9	11, bottom	Same
204-1	Valve	25	1	Valve	25	2	ММ, 1 mm dia.
204-2	Same	25	2	Same	25	4	Same
206-1	Capacitor	548	Bottom	Through contact			МГВСЛ, 0.35 sq.mm
207-1	Same	548	Top	Strip	8	11, bottom	Same
208-1	Same	553	Bottom	Through contact			Same
209-1	Same	553	Top	Strip	8	3, bottom	Same
210-1	Valve	19	4	Same	8	9, bottom	Same
211-1	Same	20	4	Same	8	2, bottom	Same
212-1	Inductance coil	653	3	Inductance coil	653	2	ММ, 1 mm dia.
212-2	Same	653	2	Strip	8	10, top	МГВСЛ, 0.35 sq.mm
213-1	Valve	18	3	Valve	18	4	ММ, 1 mm dia.

1	2	3	4	5	6	7	8	9
	213-2	Valve	18	3	Capacitor	545	Bottom	МГВСЛ, 0.35 sq.mm
	214-1	Same	16	3	Strip	7	11, bottom	Same
	214-2	Strip	7	11, bottom	Valve	15	3	Same
	215-1	Valve	16	5	Strip	7	7, bottom	Same
	215-2	Strip	7	7, bottom	Valve	15	6	Same
	216-1	Valve	17	8	Capacitor	545	Top	Same
	216-2	Same	17	8	Strip	7	2, bottom	Same
	217-1	Inductance coil	652	3	Inductance coil	652	4	MM, 1 mm dia.
	217-2	Same	652	4	Strip	7	2, top	МГВСЛ, 0.35 sq.mm
	218-1	Valve	15	1	Same	7	9, bottom	Same
	219-1	Same	15	4	Same	7	8, bottom	Same
	220-1	Resistor	154	1	Switch	724	I (1)	Same
	221-1	Same	153	1	Same	724	I (2)	Same
	222-1	Same	474	Top	Resistor	471	Top	Same
	1-36	Adapter	II	2	Deflection coil	659	3	Same
	37-2	Same	II	4	Same	659	2	Same
	38-2	Same	II	3	Same	659	1	Same
	45-2	Same	II	4	Focusing coil	656	1	Same
	94-2	Same	II	6	Deflection coil	659	5	Same
	96-2	Same	II	5	Same	659	4	Same
	224-1	Same	II	2	Focusing coil	659	2	Same
11, 12, 5, 36, 37	250-1	Resistor	445	1	Resistor	437	3	Same
17, 4, 25	226-1	Valve	5	3	Strip	4	3, top	Same
	0-100	Strip	4	2, bottom	Earth			Same
	174-2	Through contact			Connector	1032		PK-31
	174-3	Same			Same	1033		Same
	202-2	Same			Same	1545		Same
	202-3	Same			Same	1546		Same
	206-2	Same			Same	1024		Same

1	2	3	4	5	6	7	8	9
	206-3	Through contact			Connector	1025		PK-31
	208-2	Same			Same	1028		Same
	208-3	Same			Same	1029		Same
	218-2	Same			Same	1026		Same
	218-3	Same			Same	1027		Same
	219-2	Same			Same	1030		Same
	219-3	Same			Same	1031		Same

WIRE TABLE TO WIRING DIAGRAM No.1 OF SUPPLY UNIT БП-01
(Fig.25)

No. of wire bundle	No. of wire	From			To			Type and cross-section of wire
		Part	Ref. No. in key diagram	No. of contact	Part	Ref. No. in key diagram	No. of contact	
1	2	3	4	5	6	7	8	9
	0-1	Connector	1020	11	Earth lug	Beside 1020		МГВСЛ, 0.35 sq.mm
8, 1	0-2	Vitrified resistor	62	1	Same	Beside 1020		Same
8, 4, 2, 9	0-3	Same	62	1	Capacitor	132	1	Same
9	0-4	Capacitor	132	1	Same	131	1	Same
9, 3, 10	0-5	Same	131	I	Earth lug	Beside 141		Same
1	0-6	Connector	1021	8	Same	Beside 1020		Same
12, 2	0-7	Earth lug	Beside 145		Same	Beside 140		МГВСЛ, 1 sq.mm
8	0-8	Vitrified resistor	62	1	Same	Beside valve 25		МГВСЛ, 0.35 sq.mm
10, 3, 16	0-11	Earth lug	Beside 141		Same	Beside 143		МГВСЛ, 1 sq.mm
10	0-12	Same	Beside 141		Transformer	141	20	Same
10, 3, 17	0-13	Same	Beside 141		Earth lug	Beside 143		Same

 HUM

1	2	3	4	5	6	7	8	9
3, 17	0-14	Capacitor	118	2	Earth lug	Beside 143		МГВСЛ, 0.35 sq.mm
17, 3, 11, 2	0-15	Earth lug	Beside 143		Same	Beside 140		МГВСЛ, 1 sq.mm
	0-16	Capacitor	120	2	Capacitor	121	2	МГВСЛ 0.35 sq.mm
	0-17	Same	121	2	Same	122	2	Same
12, 2	0-18	Same	122	2	Earth lug	Beside 140		Same
2	0-19	Same	119	1	Same	Beside 140		Same
2	0-20	Same	119	1	Capacitor	128	2	Same
4, 2	0-21	Adapter	XIII	6	Earth lug	Beside 140		МГВСЛ, 1 sq.mm
2, 11	0-23	Earth lug	Beside 140		Transformer	140	4	Same
11	0-24	Transformer	140	4	Same	140	9	Same
17	0-25	Earth lug	Beside 143		Capacitor	135	2	Same
16	0-26	Earth lug	Beside 142		Transformer	142	4	МГВСЛ, 0.35 sq.mm
8, 3, 16	0-27	Same	Beside valve 25		Same	143	4	Same
12	0-29	Same	Beside 145		Adapter	XV	4	Same
2	0-32	Strip (terminal)	XX	2, bottom	Earth lug	Beside 140		Same
16	0-33	Transformer	143	4	Same	Beside 142		МГВСЛ, 1 sq.mm
2, 4	1-1	Same	141	13	Adapter	XIII	1	МГВСЛ, 3 sq.mm
2	1-2	Same	141	13	Capacitor	119	2	МГВСЛ, 0.35 sq.mm
2, 11, 3	1-3	Capacitor	119	2	Same	118	1	Same
3, 18	1-4	Same	118	1	Choke	144	1	Same

1	2	3	4	5	6	7	8	9
1, 4, 2	2-1	Connector	1020	13	Adapter	IV	8	МГВСЛ, 0.35 sq.mm
2, 9, 3	2-2	Adapter	IV	8	Strip (terminal)		4, bottom	Same
2, 4, 8	3-1	Same	IV	9	Vitrified resistor	82	1	Same
2, 5	3-2	Same	IV	9	Adapter	XIII	21	Same
12, 2	3-3	Same	XV	11	Same	IV	9	Same
2, 12	4-1	Same	IV	7	Same	XV	6	Same
2, 13	4-2	Same	IV	7	Strip	XX	1, bottom	Same
10, 2, 5	5-1	Transformer	141	14	Adapter	XIII	12	МГВСЛ, 3 sq.mm
1, 4, 2	6-1	Connector	1020	1	Same	IV	4	МГВСЛ, 0.35 sq.mm
4, 2	6-2	Adapter	XIII	7	Same	IV	4	Same
2	7-1	Same	IV	2	Capacitor	128	1	Same
2, 20	7-2	Capacitor	128	1	Same	125	1	Same
20	7-3	Same	125	1	Same	124	1	Same
20, 14, 2, 11	7-4	Same	124	1	Transformer	140	7	Same
2, 13	7-5	Adapter	IV	2	Strip	XX	3, bottom	Same
2, 12	8-1	Same	IV	3	Adapter	XVII	17	Same
2, 9, 3	8-2	Same	IV	3	Strip	XI	1, top	Same
		Resistor	95	95	Capacitor		2	ПВГ
	10-1	Capacitor	131	2	Transformer	143	8	Same
	10-2	Transformer	143	8	Valve	22	1	Same
	11-1	Same	143	7	Same	22	4	
8, 3	12-1	Valve	25	5	Strip	XI	5, bottom	МГВСЛ, 0.35 sq.mm
3, 12	12-2	Strip	XI	5, bottom	Adapter	XVI	1	Same
8	12-3	Valve	25	5	Valve	24	6	Same
8	13-1	Same	24	6	Same	23	6	Same
8, 3, 12	14-1	Same	23	7	Adapter	XVI	7	Same
8, 3, 12	15-1	Same	24	7	Same	XVI	18	Same
3, 12	16-1	Strip	XI	3, top	Same	XVII	6	Same
8, 3	17-1	Valve	25	2	Strip	XI	3, bottom	Same

1	2	3	4	5	6	7	8	9
8	18-1		24	5	Valve	23	5	МГВСЛ, 0.35 sq.mm
8	19-1	Same	23	3	Same	24	3	Same
8,3	20-1	Same	24	4	Vitrified resistor	59	1	Same
3, 18	20-2	Vitrified resistor	59	1	Choke	144	2	Same
18, 3	20-3	Choke	144	2	Capacitor	117	1	Same
3, 12	20-4	Capacitor	117	1	Same	120	1	Same
	20-5	Same	120	1	Same	121	1	Same
	20-6	Same	121	1	Same	122	1	Same
12, 3, 7	20-7	Same	122	1	Adapter	XIV	12	Same
3, 7, 8	21-1	Strip	XI	2, bottom	Valve	25	6	Same
3, 7	22-1	Same	XI	1, bottom	Resistor	107		Same
3, 12	22-2	Same	XI	1, bottom	Adapter	XVI	6	Same
7, 3, 12	23-1	Resistor	107		Same	XV	13	МГВСЛЭ, 0.35 sq.mm
7, 3, 12	24-1	Same	108		Same	XV	12	Same
8, 7, 3, 17	25-1	Valve	25	4	Capacitor	134	2	Same
17, 3, 12	25-2	Capacitor	134	2	Adapter	XV	2	Same
16, 3, 7, 8	26-1	Transformer	143	3	Valve	25	7	МГВСЛ, 0.35 sq.mm
16, 3, 12	26-2	Same	143	3	Adapter	XVI	17	Same
16, 3, 7, 8	27-1	Same	143	5	Valve	23	2	Same
8	27-2	Valve	23	2	Same	24	2	Same
16, 3, 7, 8	28-1	Transformer	143	6	Valve	23	8	Same
8	28-2	Valve	23	8	Same	24	8	Same
1, 4, 2, 13	29-1	Connector	1022	3	Adapter	V	5	Same
13, 2, 12	29-2	Adapter	V	5	Same	XVI	5	Same
1, 4, 2, 13	30-1	Connector	1022	1	Same	V	6	Same
1	31-1	Same	1022	2	Connector	1021	2	Same
	32-1	Terminal	1067		Transformer	141	3	ДПРГС, 6 sq.mm
1	33-1	Connector	1022	4	Connector	1021	1	МГВСЛ, 0.35 sq.mm

SECRET

909   909

1	2	3	4	5	6	7	8	9
1, 4, 2, 9	34-1	Connector		3	Transformer	141	6	МГВСЛ, 1 sq.mm
1, 4, 2, 10	35-1	Same		5	Same	141	7	Same
1, 4, 2, 10	36-1	Same		4	Same	141	8	Same
1, 4, 2, 9	37-1	Same	1020	7	Same	141	9	Same
1, 4, 2, 9	38-1	Same	1020	6	Same	141	10	Same
1,4, 2, 10	39-1	Same	1020	9	Same	141	11	Same
1, 4, 2, 10	40-1	Same	1020	8	Same	141	12	Same
9, 2, 14, 20	41-1	Transformer	141	16	Capacitor	124	2	МГВСЛ, 0.35 sq.mm
20, 14, 2, 12	41-2	Capacitor	124	2	Choke	145	2	Same
9, 2, 4	41-3	Transformer	141	16	Adapter	XIII	8	МГВСЛ, 1 sq.mm
2, 5	42-1	Same	141	15	Same	XIII	19	Same
9, 2, 4	43-1	Same	141	17	Same	XIII	9	МГВСЛ, 2 sq.mm
10, 2, 5	44-1	Same	141	18	Same	XIII	20	Same
9, 2, 4	45-1	Same	141	19	Same	XIII	10	МГВСЛ, 1 sq.mm
9, 2, 4	45-2	Same	141	19	Same	XVII	3	МГВСЛ, 0.35 sq.mm
11, 2, 12	46-1	Same	140	1	Same	XV	22	МГВСЛ, 1 sq.mm
11, 3, 7, 8	47-1	Same	140	6	Same	XVI	1	МГВСЛ, 0.35 sq.mm
11, 2, 5	48-1	Same	140	8	Same	XIII	22	Same
5, 2, 11	49-1	Adapter	XIII	14	Transformer	140	3	Same
11, 2, 5	50-1	Transformer	140	5	Adapter	XIII	18	Same
17, 3, 12	51-1	Same	143	1	Same	XVII	16	Same
7, 3, 12	52-1	Transformer	142	1	Same	XVI	16	Same
	53-1	Same	142	3	Insulator			ПВГ
16, 3, 12	54-1	Same	142	5	Adapter	XV	17	МГВСЛ, 0.35 sq.mm

1	2	3	4	5	6	7	8	9
11, 3, 12	55-1	Transformer	140	10	Adapter	XVII	4	МГВСЛ, 0.35 sq.mm
12, 2, 14	56-1	Choke	145	1	Capacitor	125	2	Same
14, 2, 4, 8	56-2	Capacitor	125	2	Adapter	XIV	5	Same
12, 3	56-3	Choke	145	1	Capacitor	126	2	Same
3, 12	56-4	Capacitor	126	2	Adapter	XVI	19	Same
12, 3, 7, 8	57-1	Adapter	XVI	4	Same	XIV	9	Same
12, 3, 7, 8	58-1	Same	XVI	2	Same	XIV	7	Same
12, 3, 7	59-1	Same	XVII	7	Same	XIV	18	Same
4	60-1	Vitrified resistor	81	2	Same	XIII	3	Same
12, 3, 7, 8	61-1	Adapter	XVII	18	Same	XIV	10	Same
12, 3, 7	62-1	Same	XVII	20	Same	XIV	21	Same
12, 3, 7, 1	63-1	Same	XVII	10	Vitrified resistor	62	2	Same
2, 8	63-2	Vitrified resistor	62	2	Adapter	XIV	8	Same
12, 3	64-1	Adapter	XVII	21	Strip	XI	5, top	Same
12, 3	65-1	Same	XVII	9	Capacitor	117	2	Same
12, 3	66-1	Same	XVI	15	Same	126	1	Same
3, 7	66-2	Capacitor	126	1	Adapter	XIV	22	Same
12, 3, 7	67-1	Adapter	XVI	14	Same	XIV	19	Same
12, 3, 7, 8	68-1	Same	XVI	13	Same	XIV	6	Same
12, 2, 13	69-1	Same	XVII	13	Strip	XX	1, top	Same
12, 2, 4	106-5	Same	XVII	2	Adapter	XIII	2	Same
12, 3, 7, 8	71-1	Same	XVII	12	Same	XIV	2	Same
12, 3, 7	72-1	Same	XVII	1	Same	XIV	14	Same
12, 3, 7, 8	73-1	Same	XV	21	Same	XIV	3	Same
12, 3, 7	74-1	Same	XV	10	Same	XIV	15	Same
12, 3, 7, 8	75-1	Same	XV	20	Same	XIV	4	Same
12, 3, 7	76-1	Adapter	XV	9	Adapter	XIV	16	Same
12, 2, 4	77-1	Same	XV	19	Same	XIII	11	Same
12, 3, 7	78-1	Same	XV	8	Same	XIV	13	Same
12, 2, 5	81-1	Same	XV	16	Same	XIII	13	МГВСЛЭ, 0.35 sq.mm
12, 2, 4	106-6	Same	XV	5	Same	XIII	4	Same

1	2	3	4	5	6	7	8	9
12, 2, 13	114-2	Adapter	XV	7	Strip	XX	5, bottom	МГВСЛЭ,0.35 sq.mm
12, 2, 13	115-2	Same	XV	18	Same	XX	4, bottom	Same
7, 1	85-1	Same	XIV	17	Vitrified resistor	81	1	МГВСЛ, 0.35 sq.mm
12, 2, 13	89-1	Same	XVI	3	Adapter	V	3	Same
12, 2, 13	90-1	Same	XV	14	Strip	XX	3, top	Same
12, 2, 13	91-1	Same	XVI	12	Adapter	V	4	Same
3, 7	92-1	Vitrified resistor	60	1	Same	XIV	20	Same
1, 4, 2, 9	93-1	Connector	1020	2	Transformer	141	5	МГВСЛ, 1 sq.mm
	94-1	Terminal	1068		Same	141	4	ЛПРГС, 6 sq.mm
	95-1	Connector	1018		Resistor	95		ПВГ
	95-2	Resistor	95		Insulator			Same
	95-3	Same	95		Capacitor	134		Same
	98-1	Same	59	2	Resistor	60	2	МН, 1 mm dia.
1, 4, 2, 13	A-1	Connector	1021	3	Adapter	VI	1	МГВСЛ, 2 sq.mm
12, 2, 13	A ан-1	Adapter	XVII	15	Same	VI	7	МГВСЛ,1 sq.mm
1, 7, 3, 17	A нак-1	Connector	1020	10	Transformer	143	2	МГВСЛ, 0.35 sq.mm
17, 3, 10	A нак-2	Transformer	143	2	Same	141	2	Same
10, 2, 13	A нак-3	Same	141	2	Adapter	VI	4	МГВСЛ, 1 sq.mm
13, 2, 15	A нак-4	Adapter	VI	4	Fan	188	1	МГВСЛ, 0.35 sq.mm
1, 4, 2, 13	B-1	Connector	1021	5	Adapter	VI	2	МГВСЛ, 2 sq.mm
13, 2, 12	B-2	Adapter	VI	2	Same	XVII	8	МГВСЛ, 0.35 sq.mm
11, 3, 7	B ан-1	Transformer	140	2	Transformer	142	2	Same
11, 2, 13	B ан-2	Same	140	2	Adapter	VI	8	МГВСЛ, 1 sq.mm
1, 4, 2, 9	B нак-1	Connector	1020	12	Transformer	141	1	МГВСЛ, 0.35 sq.mm

1	2	3	4	5	6	7	8	9
9, 2, 12	B нак-2	Transformer	141	1	Adapter	XVII	5	МГВСЛ, 0.35 sq.mm
9, 2, 13	B нак-3	Same	141	1	Same	VI	5	МГВСЛ, 1 sq.mm
13, 2, 15	B нак-4	Adapter	VI	5	Fan	188	2	МГВСЛ, 0.35 sq.mm
1, 4, 2, 13	C-1	Connector	1021	7	Adapter	VI	3	Same
13, 2, 12	C-2	Adapter	VI	3	Same	XVII	19	Same
13, 2, 12	C-3	Same	V	7	Same	XVII	14	Same
15, 2, 13	C нак-1	Fan	188	3	Same	VI	6	Same

WIRE TABLE TO WIRING DIAGRAM No.2 OF SUPPLY UNIT БП-01
(Fig.26)

No. of wire bundle	No. of wire	From			To			Type and cross-section of wire
		Part	Ref. key diagram	No. of contact	Part	key diagram	No. of contact	
1	2	3	4	5	6	7	8	9
15, 14	0-22	Adapter	XIII	6	Earth lug	Beside valve 16		МГВСЛ, 1 sq.mm
5, 14	0-40	Valve	18	2	Same	Beside valve 16		Same
5	0-41	Same	18	2	Valve	17	2	Same
14, 9, 10, 2, 8	0-42	Earth lug	Beside valve 15		Strip (terminal)		3, top	Same
14, 11	0-43	Same	Beside valve 15		Valve	16	2	Same
14, 11	0-44	Same	Beside valve 16		Same	16	2	МГВСЛ, 0.35 sq.mm
1, 9, 14, 15	1-5	Valve	2	1	Adapter	XIII	1	МГВСЛ, 3 sq.mm
15, 5, 8	3-4	Adapter	XIII	21	Strip	III	6, top	МГВСЛ, 0.35 sq.mm
9,14, 15	5-2	Valve	4	1	Adapter	XIII	12	МГВСЛ, 3 sq.mm
14, 15	6-3	Same	19	2	Same	XIII	7	МГВСЛ, 0.35 sq.mm
8, 3, 10, 13, 14	6-4	Strip (terminal)		4, top	Valve	19	2	Same

1	2	3	4	5	6	7	8	9
8	6-5	Strip (terminal)		4, top	Strip	III	3, bottom	МГВСЛ, 0.35 sq.mm
15, 14, 13, 10, 2	20-8	Adapter		12	Valve	11	3	Same
15, 13, 2	106-3	Same	XIII	4	Strip		11, top	Same
3, 10, 4	20-10	Same	11	3	Valve	10	3	Same
4, 8, 2	20-11	Same	10	3	Same	9	3	Same
2, 8, 3	20-12	Valve	9	3	Same	8	3	Same
3, 8, 4	20-13	Same	8	3	Same	7	3	Same
4, 8, 5	20-14	Same	7	3	Same	6	3	Same
5, 8, 6	20-15	Same	6	3	Same	29	3	Same
6, 8, 7	20-16	Same	29	3	Same	28	3	Same
15, 14, 13	41-4	Adapter	XIII	8	Same	5	2	МГВСЛ, 1 sq.mm
15, 14	42-2	Same	XIII	19	Same	5	8	Same
15, 14	43-2	Same	XIII	9	Valve	14	8	МГВСЛ, 1 sq.mm
14, 12, 10, 2	43-3	Valve	14	8	Same	13	2	Same
2, 10, 3	43-4	Same	13	2	Same	11	2	Same
3, 10, 4	43-5	Same	11	2	Same	10	2	Same
4, 8, 7	43-6	Same	10	2	Same	28	2	Same
15, 14, 13, 10, 2	43-7	Adapter	XIII	9	Same	9	2	Same
2, 8, 3		Valve	9	2	Same	8	2	Same
3, 8, 4	43-9	Same	8	2	Same	7	2	Same
4, 8, 5	43-10	Same	7	2	Same	6	2	Same
5, 8, 6	43-11	Same	6	2	Same	29	2	Same
6,8	43-12	Same	29	2	Strip	1	2, bottom	МГВСЛ, 0.35 sq.mm
15, 14	44-2	Adapter	XIII	20	Valve	14	7	МГВСЛ, 1 sq.mm
14, 13, 10	44-3	Valve	14	7	Same	13	7	Same

SECRET

1	2	3	4	5	6	7	8	9
10	44-4	Valve	13	7	Valve	11	7	МГВСЛ, 1 sq.mm
10	44-5	Same	11	7	Same	10	7	Same
10, 6, 8	44-6	Same	10	7	Same	28	7	МГВСЛ, 1 sq.mm
6, 8	44-7	Same	6	7	Same	29	7	Same
5, 8, 6	44-8	Same	7	7	Same	6	7	Same
5, 8, 4	44-9	Same	7	7	Same	8	7	Same
4, 8, 3	44-10	Same	8	7	Same	9	7	Same
3, 8, 4, 15	44-11	Same	9	7	Adapter	XIII	20	Same
15,14	45-3	Adapter	XIII	10	Valve	16	7	Same
14	45-4	Valve	16	7	Same	15	7	Same
14, 15	45-5	Same	15	7	Same	18	7	Same
15, 6, 10	45-6	Same	18	7	Same	17	7	Same
15, 4, 10	47-2	Adapter	XIV	1	Same	5	4	МГВСЛ, 0.35 sq.
15, 14	48-2	Same	XIII	22	Same	5	6	Same
15, 14, 13, 10, 2	49-2	Same	XIII	14	Same	1	4	Same
	49-3	Valve	1	4	Same	2	4	Same
15, 14, 13, 10, 2	50-2	Adapter	XIII	18	Same	3	4	Same
	50-3	Valve	3	4	Same	4	4	Same
8, 6, 14	58-4	Strip	III	14	Same	19	3	Same
15, 5, 8	56-5	Adapter	XIV	5	Strip	III	4, top	Same
15, 6, 8	57-2	Same	XIV	9	Same	I	4, bottom	Same
15, 6, 8	58-2	Same	XIV	7	Same	III	1, top	Same
8, 6, 10	58-3	Strip	III	1, top	Same	16	3	Same
15, 14	59-2	Adapter	XIV	18	Same	19	3	Same
15	60-2	Valve	19	7	Adapter	XIII	3	Same
15, 5	61-2	Adapter	XIV	10	Valve	18	3	Same
5, 8	61-3	Valve	18	3	Strip	III	4, bottom	Same

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1	2	3	4	5	6	7	8	9
15, 5	61-2	Adapter	XIV	21	Valve	17	3	МГВСЛ, 0.35 sq.mm
5, 8	62-3	Valve	17	3	Strip	III	5, bottom	Same
15, 4, 8	63-3	Adapter	XIV	8	Same	II	4, bottom	Same
3, 8	6-6	Capacitor	138		Same	III	3, bottom	Same
15, 6, 8	66-3	Adapter	XIV	22	Same	III	3, top	Same
15, 4	67-2	Same	XIV	19	Valve	12	2,	Same
4, 8	67-3	Valve	12	2	Strip	II	3, top	Same
15, 14, 13, 10	68-2	Adapter	XIV	6	Valve	13	8	Same
10, 3, 8	68-3	Valve	13	8	Strip	II	4, top	Same
3, 10, 4	69-3	Capacitor	138		Valve	19	5	Same
2, 13,15	106-4	Adapter	XIII	2	Strip	I	11, bottom	Same
15, 5	71-2	Same	XIV	2	Same	6	8	Same
5, 8	71-3	Valve	6	8	Same	II	2, bottom	Same
15, 4	72-2	Adapter	XIV	14	Valve	7	8	Same
4, 8	72-3	Valve	7	8	Strip	II	1, bottom	Same
15, 4, 8, 3	73-2	Adapter	XIV	3	Valve	8	8	Same
3, 8	73-3	Valve	8	8	Strip	III	11, bottom	Same
15, 5, 8, 2	74-2	Adapter	XIV	15	Valve	9	8	Same
2, 8	74-3	Valve	9	8	Strip	III	10, bottom	Same
15, 5, 10	75-2	Adapter	XIV	4	Valve	10	8	Same
10, 4, 8	75-3	Valve	10	8	Strip	III	9, bottom	Same
15, 4, 10	76-2	Adapter	XIV	16	Valve	11	8	Same
10, 4, 8	76-3	Valve	11	8	Strip	III	8, bottom	Same
15, 6, 8	77-2	Adapter	XIII	11	Valve	28	8	Same
8	77-3	Valve	28	8	Strip	III	7, bottom	Same
15, 6, 8	78-2	Adapter	XIV	13	Valve	29	8	Same
8	78-3	Valve	29	8	Strip	III	6, bottom	Same
15, 14, 11, 10	81-2	Adapter	XIII	13	Valve	15	4	МГВСЛЭ, 0.35 sq.mm
10, 2	81-3	Valve	15	4	Capacitor	130	Bottom	Same
8	83-3	Strip	I	5, bottom	Strip	III	2, bottom	Same

1	2	3	4	5	6	7	8	9
10, 6, 8	83-4	Valve	17	1	Strip	III	2, bottom	МГВСЛЭ, 0.35 sq.mm
10, 11, 2, 8	89-2	Same	15	6	Same	I	2, top	МГВСЛ, 0.35 sq.mm
8, 6	108-1	Strip	I	1, bottom	Valve	17	6	Same
15, 14, 12	89-5	Valve	16	6	Adapter	XIV	17	Same
12, 14, 11	89-6	Same	16	6	Valve	15	6	Same
15	92-2	Same	12	7	Adapter	XIV	20	Same
1, 9,10	99-1	Same	2	8	Valve	4	8	МГВСЛ, 2 sq.mm
10	99-2	Same	3	8	Same	4	8	МГВСЛ, 1 sq.mm
1	99-3	Same	1	8	Same	2	8	Same
9	100-1	Same	2	2	Same	4	2	МГВСЛ, 2 sq.mm
1, 9	100-2	Same	1	2	Same	2	2	МГВСЛ, 1 sq.mm
10, 9	100-3	Same	3	2	Same	4	2	Same
8	101-1	Strip	II	1, top	Strip	III	11, top	МГВСЛ, 0.35 sq.mm
8	102-1	Same	1	7, top	Same	II	2, top	Same
12, 10, 2	103-1	Valve	14	2	Capacitor	130	Top	Same
10, 2, 8	103-2	Same	14	5	Strip	I	11, bottom	Same
10, 3	103-3	Same	14	5	Valve	13	6	Same
14	104-1	Valve	16	8	Valve	14	1	Same
10, 2, 8	104-2	Same	14	4	Strip	I	7, bottom	Same
10, 2, 8	105-1	Same	14	3	Same	I	6, top	Same
13, 10, 6, 8	105-2	Same	14	6	Same	III	2, top	Same
2, 8	106-1	Same	13	1	Same	I	8, bottom	Same
14, 10, 2	106-2	Same	15	8	Same	I	8, bottom	Same
8	107-1	Strip	I	3, bottom	Same	II	5, bottom	Same
8, 4	107-2	Same	II	5, bottom	Valve	12	3	Same
4, 10, 5	107-3	Valve	12	3	Same	10	6	Same

1	2	3	4	5	6	7	8	9
5, 10, 4	107-4	Valve	10	6	Valve	11	6	МГВСЛ, 0.35 sq.mm
4, 8, 3	107-5	Same	11	6	Same	9	6	Same
3, 8, 4	107-6	Same	9	6	Same	8	6	Same
4, 8, 5	107-7	Same	8	6	Same	7	6	Same
5, 8, 6	107-8	Same	7	6	Same	6	6	Same
6, 8, 7	107-9	Same	6	6	Same	29	6	Same
7, 8	107-10	Same	29	6	Same	28	6	Same
8, 6	108-3	Strip	I	9, top	Same	18	4	МГВСЛЭ, 0.35 sq.mm
8, 6	107-11	Same	I	10, top	Same	18	5	Same

WIRE TABLE TO WIRING DIAGRAM No.3 OF SUPPLY UNIT БП-01
(Fig.27)

No. of wire bundle	No. of wire	From			To			Type and cross-section of wire
		Part	Ref. key diagram	No. of contact	Part	key diagram	No. of contact	
1	2	3	4	5	6	7	8	9
11, 4	0-30	Adapter	XV	4	Receptacle	VIII	2, short	МГВСЛ , 1 sq.mm
4	0-46	Receptacle	VIII	2, short	Earth lug	Beside 20		МГВСЛ, 0.35 sq.mm
4	0-47	Earth lug			Valve	20	2	МГВСЛ, 1 sq.mm
4	0-48	Valve	20	2	Same	26	2	МГВСЛ, 0.35 sq.mm
4	0-49	Same	26	2	Same	27	2	Same
4	0-50	Same	27	2	Same	21	2	Same
4, 10, 7	0-51	Earth lug	Beside 20		Earth lug	Beside 111		Same
3, 10, 4	0-52	Receptacle	VIII	3, long	Same	Beside 20		Same
7, 10, 1	0-53	Earth lug	Beside 111		Receptacle	VII	2, long	Same
4	0-54	Capacitor	127		Earth lug	Beside 20		Same
4, 11	3-4	Same	127		Adapter	XV	11	Same
11, 4	4-3	Adapter	XV	6	Receptacle	VIII	12, short	Same
1, 11, 4	4-5	Receptacle	VII	5, long	Same	VIII	5, short	Same

1	2	3	4	5	6	7	8	9
11, 2	8-3	Adapter	XVII	17	Receptacle	VII	13, short	МГВСЛ, 0.35 sq.mm
2	8-4	Receptacle	VII	13, short	Same	VII	3, short	Same
11, 2	12-4	Adapter	XVI	1	Same	VII	8, short	Same
11, 1	14-2	Same	XVI	7	Same	VII	7, long	Same
11, 1	15-2	Same	XVI	18	Same	VII	8, long	Same
11, 2	16-2	Same	XVII	6	Same	VII	5, short	Same
11, 1	22-3	Same	XVI	6	Same	VII	4, long	Same
11, 3, 10, 7	23-2	Same	XV	13	Potentiometer	111	3	МГВСЛЭ, 0.35 sq.mm
11, 3, 10, 7	24-2	Same	XV	12	Same	111	1	Same
11, 3, 10, 7	25-3	Adapter	XV	2	Potentiometer	111	2	Same
11, 4	26-3	Same	XVI	17	Valve	27	1	МГВСЛ, 0.35 sq.mm
11, 1	29-3	Same	XVI	5	K.B.A.	152	1	Same
11, 4	45-3	Same	XVII	3	Valve	21	1	Same
11, 3, 5	46-2	Same	XV	22		182	2	МГВСЛ, sq.mm
5, 10, 9	46-3		182	2	Same	183	1	МГВСЛ, 0.35 sq.mm
11, 2, 10, 9	51-2	Adapter	XVII	16	Same	184	1	Same
11, 2, 10, 9	52-2	Same	XVI	16	Same	183	2	Same
11, 4	54-2	Same	XV	17	Valve	26	1	Same
11, 4	55-2	Same	XVII	4	Same	20	1	Same
11, 1	56-5	Same	XVI	19	Receptacle	VII	12, long	Same
1, 11	57-2	Receptacle	VII	13, long	Adapter	XVI	4	Same
1, 11	58-2	Same	VII	14, long	Same	XVI	2	Same
2, 11	59-2	Same	VII	14, short	Same	XV	7	Same
2, 11	61-2	Same	VII	12, short	Same	XV	18	Same
2, 11	62-2	Same	VII	11, short	Same	XV	20	Same
2, 11	63-3	Same	VII	10, short	Same	XVII	10	Same
2, 11	64-2	Same	VII	6, short	Same	XVII	21	Same
2, 11	65-2	Same	VII	2, short	Same	XVII	9	Same

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[redacted] 50X1-HUM

1	2	3	4	5	[redacted]	7	8	9
2, 11	66-3	Receptacle	VII	3, long	Receptacle	XVI	15	МГВСЛ, 0.35 sq.mm
2, 11	67-2	Same	VII	9, long	Same	XVI	14	Same
2, 11	68-2	Same	VII	10, long	Same	XVI	13	Same
3, 11	69-2	Same	VIII	2, long	Same	XVII	13	Same
3, 11	106-7	Same	VIII	4, long	Same	XVII	2	Same
3, 11	71-2	Same	VIII	5, long	Same	XVII	12	Same
3, 11	72-2	Same	VIII	6, long	Same	XVII	1	Same
3, 11	73-2	Same	VIII	7, long	Same	XV	21	Same
3, 11	74-2	Same	VIII	8, long	Same	XV	10	Same
3, 11	75-2	Same	VIII	9, long	Same	XV	20	Same
3, 11	76-2	Receptacle	VIII	10, long	Adapter	XV	9	Same
3, 11	77-2	Same	VIII	11, long	Same	XV	19	Same
3, 11	78-2	Same	VIII	, long	Same	XV	8	Same
8, 10, 3, 11	81-2	Potentiometer	110	2	Same	XV	16	МГВСЛЭ, 0.35 sq.mm
11, 4	106-8	Receptacle	VIII	4, short	Same	XV	5	МГВСЛ, 0.35 sq.mm
11, 3, 10, 8	114-1	Potentiometer	110	3	Same	XV	7	МГВСЛЭ, 0.35 sq.mm
11, 3, 10, 8	115-1	Same	110	1	Same	XV	18	
11, 1	89-7	Adapter	XVI	3	КВН	151	2	МГВСЛ, 0.35 sq.mm
1	89-8	КВН	151	2	КОВ	150	4	Same
4, 11	90-2	Receptacle	VIII	3, short	Adapter	XV	14	Same
11, 1	91-2	Adapter	XVI	12	КВН	151	1	Same
5, 10, 1	109-1		181	2	КОВ	150	3	Same
5, 10, 3, 11	А ан-2	Same	182	1	Adapter	XVII	15	МГВСЛ, 1 sq.mm
11, 2, 10, 9	В нак-5	Adapter	XVII	5		184	2	МГВСЛ, 0.35 sq.mm
11, 3, 10, 5	В-3	Same	XVII	8	Same	180	2	Same
5, 10, 1	В-4		180	1	Jack	190	1	МГВСЛ, 1 sq.mm
11, 1	С-3	Adapter	XVII	19	Same	190	2	МГВСЛ, 0.35 sq.mm
11, 3, 10, 5	С-4	Same	XVII	14		181	1	Same

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WIRE TABLE TO WIRING DIAGRAM No.4 OF SUPPLY UNIT
(Fig.28)

No. of wire bundle	No. of wire	From			To			Type and cross-section of wire
		Part	Ref. No. in key diagram	No. of contact	Part	Key diagram	No. of contact	
1	2	3	4	5	6	7	8	9
13	29-1	Connector	1022	3	Adapter	V	5	МГВСЛ, 0.35 sq.mm
13	29-2	Adapter	V	5	Same	XVI	5	Same
1, 2, 3	29-4	Same	V	5	Anode voltage circuit breaker	156	8	Same
1, 2, 3	30-2	Same	V	6	Same	156	10	Same
13	89-1	Same	XVI	3	Adapter	V	3	Same
1	89-9	Same	V	3	Heater voltage circuit breaker	153	8	Same
13	91-1	Same	XVI	12	Adapter	V	4	Same
3, 2, 1	91-3	Auxiliary relay	155	10	Same	V	4	Same
1	91-4	Adapter	V	4	Heater voltage circuit breaker	153	9	Same
3	91-5	Auxiliary relay	155	10	Thermal relay	154	2	Same
1	91-6	Heater voltage circuit breaker	153	9	Heater voltage circuit breaker	153	10	Same
1, 2, 3	91-7	Same	153	10	Anode voltage circuit breaker	156	9	Same
3	110-1	Thermal relay	154	3	Resistor	39	1	Same

1	2	3	4	5	6	7	8	9
3	111-1	Auxiliary relay	155	8	Thermal relay	154	1	МГВСЛ, 0.35 sq.mm
3	111-2	Same	155	8	Auxiliary relay	155	9	Same
3, 2, 1	112-1	Resistor	39	2	Same	155	7	Same
1, 2, 3, 5	113-1	Auxiliary relay	155	2	Anode relay	156	14	Same
1, 2	A-2	Adapter	VI	1	Heater voltage circuit breaker	153	1	МГВСЛ, 2 sq.mm
5, 3, 2	A-3	Anode voltage circuit breaker	156	1	Same	153	1	МГВСЛ, 1 sq.mm
1	A-4	Adapter	VI	1	Auxiliary relay	155	6	МГВСЛ, 0.35 sq.mm
1	A-5	Auxiliary relay	155	6	Same	155	3	Same
1	A-6	Auxiliary relay	155	3	Same	155	1	Same
1, 2, 3	A-7	Same	155	1	Heater voltage circuit breaker	153	14	Same
3	A-8	Heater voltage circuit breaker	153	14	Auxiliary relay	155	13	Same
13	A ан-1	Adapter	XVII	15	Adapter	VI	7	МГВСЛ, 1 sq.mm
1, 2, 3, 4	A ан-3	Same	VI	7	Anode voltage circuit breaker	156	4	Same
13	A нак-3	Transformer	141	2	Adapter	VI	4	Same
13	A нак-4	Adapter	VI	4	Fan	188	1	МГВСЛ, 0.35 sq.mm
1, 2, 3	A нак-5	Same	VI	4	Heater voltage circuit breaker	153	4	МГВСЛ, 1 sq.mm
13	B-1	Connector	1021	5	Adapter	VI	2	МГВСЛ, 0.35 sq.mm
13	B-2	Adapter	VI	2	Same	XVII	8	Same
1, 2	B-5	Same	VI	2	Heater voltage circuit breaker	153	2	МГВСЛ, 2 sq.mm
2, 3, 5	B-6	Heater voltage circuit breaker	153	2	Anode voltage circuit breaker	156	2	МГВСЛ, 1 sq.mm

1	2	3	4	5	6	7	8	9
13	B ан-2	Transformer	140	2	Adapter	VI	8	МГВСЛ, 1 sq.mm
1, 2, 3, 4	B ан-3	Adapter	VI	8	Anode voltage circuit breaker	156	5	Same
13	B нак-3	Transformer	141	1	Adapter	VI	5	Same
13	B нак-4	Adapter	VI	5	Fan	188	2	МГВСЛ, 0.35 sq.mm
1, 2, 3	B нак-6	Same	VI	5	Heater voltage circuit breaker	153	5	МГВСЛ, 1 sq.mm
13	C-1	Connector	1021	7	Adapter	VI	3	МГВСЛ, 0.35 sq.mm
13	C-2	Adapter	VI	3	Same	XVII	19	Same
13	C-3	Same	V	7	Same	XVII	14	Same
1	C-5	Same	VI	3	Same	V	7	Same
1, 2	C-6	Same	VI	3	Heater voltage circuit breaker	153	3	МГВСЛ, 1 sq.mm
13	C нак-1		188	3	Adapter	VI	6	МГВСЛ, 0.35 sq.mm
1, 2, 3	C нак-2	Adapter	VI	6	Heater voltage circuit breaker	153	6	МГВСЛ, 1 sq.mm

WIRE TABLE TO WIRING DIAGRAM No.1 OF SUPPLY UNIT БП-02
(Fig.29)

No. of wire bundle	No. of wire	From			To			Type and cross-section of wire
		Part	Ref. key diagram	No. of contact	Part	key diagram	No. of contact	
1	2	3	4	5	6	7	8	9
	0-1	Connector	1020	11	Earth lug	Beside 1020		МГВСЛ, 0.35 sq.mm
12	0-2	Earth lug	Beside 1019	-	Same	Beside 1020		Same
	0-3	Connector	1019	11	Same	Beside 1019		Same
12	0-4	Same	1021	8	Same	Beside 1020		Same
4, 12	0-5	Resistor	62	1	Same	Beside 1019		Same
4, 3	0-6	Same	62	-	Same	Beside 137		Same
3, 1, 6	0-7	Earth lug	Beside 137	-	Same	Beside 141		Same
	0-8	Capacitor	127	1	Same	Beside 127		Same
4	0-9	Same	127	1	Capacitor	137	2	Same
4	0-10	Same	137	2	Earth lug	Beside 137		Same
6, 1, 2	0-11	Earth lug	Beside 141		Same	Beside 118		МГВСЛ, 1 sq.mm

1	2	3	4	5	6	7	8	9
1, 2	0-12	Capacitor	118	2	Earth lug	Beside 118		МГВСЛ, 0.35 sq.mm
2, 1, 5, 8	0-13	Earth lug	Beside 118		Same	Beside 140		МГВСЛ, 1 sq.mm
8	0-14	Capacitor	122	2	Same	Beside 140		МГВСЛ, 0.35 sq.mm
	0-15	Same	122	2	Capacitor	121	2	Same
	0-16	Same	121	2	Same	120	2	Same
5	0-18	Transformer	140	4	Transformer	140	9	Same
5, 8	0-19	Same	140	4	Earth lug	Beside 119		Same
8	0-20	Earth lug	Beside 140		Same	Beside 119		МГВСЛ, 1 sq.mm
8	0-21	Same	Beside 119		Capacitor	119	2	Same
8	0-22	Capacitor	119	2	Same	128	1	МГВСЛ, 0.35 sq.mm
3, 8	0-23	Block	XIII	17	Earth lug	Beside 119		МГВСЛ, 1 sq.mm
10	0-25	Strip (terminal)	XX	2, bottom	Same	Beside XX		МГВСЛ, 0.35 sq.mm
6, 1	0-26	Earth lug	Beside 141		Block	XVI	1	МГВСЛ, 1 sq.mm
6	0-27	Transformer	141	20	Earth lug	Beside 141		Same
9, 8	0-28	Earth lug	Beside XX		Same	Beside 121		МГВСЛ, 0.35 sq.mm
	0-30	Same	Beside 121		Block	XVI	12	МГВСЛ, 1 sq.mm
9, 8, 10	1-2	Block	XV	12	Strip (terminal)	XX	1, bottom	МГВСЛ, 0.35 sq.mm
10, 8	1-3	Strip	XX	1, bottom	Block	IV	7	Same
8, 4	1-4	Block	IV	7	Capacitor	127	2	Same
6	1-5	Capacitor	127	2	Same	137	1	Same

1	2	3	4	5	6	7	8	9
4, 3	1-6	Capacitor	137	1	Block	XIV	17	МГВСЛ, 0.35 sq.mm
12, 4, 8	1-7	Block	IV	8	Connector	1019	13	Same
4, 8	1-8	Same	IV	9	Resistor	82	1	Same
12, 4, 8	1-9	Same	IV	9	Connector	1020	13	Same
1, 5	2-3	Same	XVI	13	Transformer	140	7	Same
5, 8	2-4	Transformer	140	7	Capacitor	128	2	Same
8	2-5	Capacitor	128	2	Block	IV	2	Same
8, 4, 12	2-6	Block	IV	3	Connector	1020	1	Same
8, 3	2-7	Same	IV	3	Block	XIV	18	Same
8, 4, 12	2-8	Same	IV	2	Connector	1019	1	Same
8, 3	2-9	Same	IV	4	Block	XIII	18	Same
11, 8	2-10	Same	IV	4	Capacitor	125	1	Same
11	2-11	Capacitor	125	1	Same	124	2	Same
11, 8, 10	2-12	Same	124	2	Strip	XX	3, bottom	Same
1, 5, 8, 10	3-2	Block	XVI	9	Block	V	5	Same
10, 8, 4, 12	3-3	Same	V	5	Connector	1019	9	Same
9, 8, 7	4-2	Same	XV	2	Transformer	141	19	Same
7, 8, 3	4-3	Transformer	141	19	Block	XIII	21	МГВСЛ, 1 sq.mm
5, 8, 9	5-2	Block	XV	13	Transformer	140	10	МГВСЛ, 0.35 sq.mm
1, 5, 8, 9	6-2	Same	XVI	20	Choke	145	1	Same
9, 8, 11	6-3	Choke	145	1	Capacitor	125	2	Same
11, 8, 6, 1	6-4	Capacitor	125	2	Capacitor	126	2	Same
1, 3, 4	6-5	Same	126	2	Block	XIII	10	Same
1	7-2	Block	XVI	14	Capacitor	117	2	Same
1, 3, 4	8-2	Same	XVI	7	Block	XIV	11	Same
9, 8, 3	9-2	Same	XV	16	Same	XIV	13	Same
9, 8, 3	10-2	Same	XV	6	Same	XIV	15	Same
9, 8, 4	11-2	Same	XV	17	Same	XIV	3	Same
9, 8, 3	12-2	Same	XV	7	Same	XIV	14	Same
9, 8, 4	13-2	Same	XV	18	Same	XIII	3	Same

1	2	3	4	5	6	7	8	9
9, 8, 4	14-2	Block	XV	8	Block	XIV	9	МГВСЛ, 0.35 sq.mm
9, 8, 4	15-2	Same	XV	19	Same	XIV	2	Same
9, 8, 3	16-2	Same	XV	9	Same	XIV	12	Same
9, 8, 3	71-5	Same	XV	20	Same	XIII	13	Same
9, 8, 10	18-2	Same	XV	3	Strip	XX	3, top	Same
9, 8, 10	19-2	Same.	XV	14	Same	XX	1, top	Same
1, 3, 12	20-2	Same	XVI	4	Resistor	62	2	Same
12, 4	20-3	Same	62	2	Block	XIV	6	Same
1	21-2	Block	XIV	15	Capacitor	126	1	Same
1, 3	21-3	Capacitor	126	1	Block	XIII	22	Same
1, 3, 4	22-2	Block	XVI	5	Same	XIV	7	Same
1, 3	23-2	Same	XVI	10	Same	XIV	20	Same
1, 3	24-2	Same	XVI	21	Same	XIV	16	Same
1, 3, 4	25-2	Same	XVI	18	Same	XIV	10	Same
1, 3	26-2	Same	XVI	6	Same	XIV	21	Same
1, 3	27-2	Same	XVI	16	Same	XIV	22	Same
9, 8, 4	71-7	Same	XV	15	Same	XIII	4	Same
1, 3, 8, 4	33-2	Same	XVI	2	Same	XIII	2	МГВСЛЭ, 0.35 sq.mm
10, 9	34-3	Same	XV	1	Same	V	4	МГВСЛ, 0.35 sq.mm
1, 5, 8, 10	35-3	Same	XVI	11	Same	V	3	Same
8, 4,	40-1	Transformer	141	13	Same	XIII	1	МГВСЛ, 3 sq.mm
8	40-2	Same	141	13	Capacitor	119	1	МГВСЛ, 0.35 sq.
8, 5, 1	40-3	Capacitor	119	1	Same	118	1	Same
1, 2	40-4	Same	118	1	Choke	144	2	Same
6, 8, 3	41-1	Transformer	141	14	Block	XIII	12	МГВСЛ, 3 sq.mm
12, 4, 8, 7	[illegible]2-1	Connector	1020	2	Transformer	141	5	МГВСЛ, 1 sq.mm
12, 4, 8, 7	42-2	Transformer	141	5	Connector	1019	2	Same
12, 4, 8, 6	43-1	Connector	1020	5	Transformer	141	7	Same

1	2	3	4	5	6	7	8	9
12, 4, 8, 7	44-1	Connector	1020	6	Transformer	141	10	МГВСЛ, 1 sq.mm
12, 4, 8, 7	45-1	Same	1020	7	Same	141	9	Same
12, 4, 8, 6	46-1	Same	1020	8	Same	141	12	Same
12, 4, 8, 6	47-1	Same	1020	9	Same	141	11	Same
3, 8, 4	48-1	Block	XIII	14	Resistor	81	1	МГВСЛ, 0.35 sq.mm
12, 4, 8, 6	49-1	Connector	1020	4	Transformer	141	8	МГВСЛ, 1 sq.mm
	50-1	Terminal	1068		Same	141	3	ЛПРГС, 6 sq.mm
	51-1	Same	1067		Same	141	4	Same
?, 3, 8, 7	52-1	Connector	1020	3	Same	141	6	МГВСЛ, 1 sq.mm
?, 8, 4, 12	52-2	Transformer	141	6	Connector	1019	3	Same
12, 4, 8, 10	53-1	Connector	1019	7	Block	V	6	МГВСЛ, 0.35 sq.mm
8, 3	56-1	Transformer	141	15	Same	XIII	19	МГВСЛ, 1 sq.mm
7, 8, 4	57-1	Same	141	16	Same	XIII	8	Same
8, 7, 9	57-2	Same	141	16	Choke	145	2	МГВСЛ, 0.35 sq.mm
9, 8, 11	57-3	Choke	145	2	Capacitor	124	1	Same
7, 8, 3	58-1	Transformer	141	17	Block	XIII	20	МГВСЛ, 2 sq.mm
6, 8, 4	59-1	Same	141	18	Same	XIII	9	Same
5, 1, 3, 4	60-1	Transformer	140	6	Block	XIV	1	МГВСЛ, 0.35 sq.mm
5, 8, 4	61-1	Same	140	8	Same	XIII	11	Same
5, 8, 4	62-1	Same	140	5	Same	XIII	7	Same
5, 8, 4	63-1	Same	140	3	Same	XIV	4	Same
2, 1	64-1	Choke	144	1	Capacitor	120	1	МГВСЛ, 0.35 sq.mm

1	2	3	4	5	6	7	8	9
	64-2	Capacitor	120	1	Capacitor	121	1	МГВСЛ, 0.35 sq.mm
	64-3	Same	121	1	Same	122	1	Same
2, 1	64-4	Choke	144	1	Resistor	59	1	Same
8, 5, 1	65-5	Capacitor	122	1	Capacitor	117	1	Same
1, 3	65-6	Same	117	1	Block	XIV	19	Same
4, 3, 1	66-1	Block	XIV	8	Resistor	60	1	Same
12, 4	67-2	Resistor	81	2	Block	XIV	5	Same
12, 4, 8, 10	A-1	Connector	1021	3	Same	VI	1	МГВСЛ, 2 sq.mm
12, 3	A нак-1	Same	1020	10	Same	IX	1	МГВСЛ, 0.35 sq.mm
12, 3	A нак-2	Same	1019	10	Same	IX	2	Same
3, 8, 6	A нак-3	Block	IX	2	Transformer	141	2	МГВСЛ, 1 sq.mm
6, 8, 10	A нак-4	Transformer	141	2	Block	VI	4	Same
3, 8	A нак-5	Block	IX	3	Same	X	2	МГВСЛ, 0.35 sq.mm
12	A ан-7	Connector	1019	6	Connector	1020	14	МГВСЛ, 1 sq.mm
12, 4, 8, 10	A ан-1	Same	1019	6	Block	VI	7	Same
10, 8, 5, 1	A ан-3	Block	VI	7	Same	XVI	8	Same
5, 1	A ан-6	Transformer	140	1	Same	XVI	22	Same
12, 4, 8, 10	B-1	Connector	1021	5	Same	VI	2	МГВСЛ, 2 sq.mm
1, 5, 8, 10	B-3	Block	XVI	19	Same	VI	2	МГВСЛ, 1 sq.mm
12, 3	B нак-1	Connector	1020	12	Same	IX	5	МГВСЛ, 0.35 sq.mm
12, 3	B нак-2	Same	1019	12	Same	IX	4	Same
7, 8, 3	B нак-3	Transformer	141	1	Same	IX	4	МГВСЛ, 1 sq.mm
7, 8, 10	B нак-4	Same	141	1	Same	VI	5	Same

1	2	3	4	5	6	7	8	9
3, 8	B нак-5	Block	IX	6	Block	X	3	МГБСЛ, 0.35 sq.mm
12, 3, 1, 5	B ан-1	Connector	1019	8	Transformer	140	2	Same
5, 8, 10	B ан-2	Transformer	140	2	Block	VI	8	МГБСЛ, 2 sq.mm
12, 4, 8, 10	C-1	Connector	1021	7	Same	VI	3	МГБСЛ, 1 sq.mm
1, 3, 8, 10	C-3	Block	XVI	17	Same	VI	3	Same
1, 5, 8, 10	C-6	Block	XVI	3	Block	V	7	МГБСЛ, 0.35 sq.mm
12, 4, 8, 10	C нак-1	Connector	1019	14	Same	VI	6	Same
10, 8	C нак-2	Block	VI	6	Same	X	1	Same
3, 8, 10	72-2	Same	XV	10	Strip	XX	5, bottom	МГЗСЛЭ, 0.35 sq.mm
3, 8, 10	73-2	Same	XV	21	Same	XX	4, bottom	Same

WIRE TABLE TO WIRING DIAGRAM No.2 OF SUPPLY UNIT БП-02
(Fig.30)

No. of wire bundle	No. of wire	From			To			Type and cross-section of wire
		Part	Ref. No. in key diagram	No. of contact	Part	Ref. No in key diagram	No. of contact	
1	2	3	4	5	6	7	8	9
10, 11	0-40	Valve	16	4	Earth lug	Beside 16		МГВСЛ, 1 sq.mm
5	0-41	Same		2	Same	Beside 17		МГВСЛ, 0.35 sq.mm
5	0-42	Same	17	2	Valve	18	2	МГВСЛ 1 sq.mm
10, 14, 12, 15	0-43	Same	16	4	Block	XIII	17	МГВСЛ, 0.35 sq.mm
	0-44	Same	15	1	Earth lug	Beside 16		
10, 6	0-45	Same	17	8	Capacitor	136	1	МГВСЛ, 0.35 sq.mm
5, 8	0-46	Earth lug	Beside 17		Strip (terminal)	I	3, top	Same
5, 8, 15	1-10	Block	XIV	17	Same	II	1, bottom	Same
8	1-11	Strip (terminal)	II	2, bottom	Same	III	11, top	Same
8	1-12	Same	III	6, top	Same	I	7, top	Same
8, 2	1-13	Same	I	11, bottom	Capacitor	130	Top	Same

1	2	3	4	5	6	7	8	9
2, 10	1-14	Capacitor	130	Top	Valve	14	5	МГВСЛ, 0.35 sq.mm
5, 10, 2	1-15	Strip	I	7, top	Same	13	1	Same
6, 8, 15	2-13	Block	XIV	18	Strip	III	3, bottom	Same
15, 14	2-14	Same	XIII	18	Valve	19	2	Same
14, 13, 3, 8	2-15	Valve	19	2	Strip	I	4, top	Same
15	4-4	Block	XIII	21	Valve	18	7	МГВСЛ, 1 sq.mm
6, 10, 15	4-5	Valve	18	7	Same	17	7	Same
10, 5, 14	4-6	Same	17	7	Same	16	7	МГВСЛ, 0.35 sq.mm
14	4-7	Same	16	7	Same	15	7	Same
15, 4, 8	6-6	Block	XIII	10	Strip	III	4, top	Same
15, 4	8-3	Same	XIV	11	Valve	12	2	Same
4, 8	8-4	Valve	12	2	Strip	II	3, top	Same
5	9-3	Block	XIV	13	Valve	6	8	Same
5, 8	9-4	Valve	6	8	Strip	II	2, top	Same
5, 8, 2, 15	10-3	Block	XIV	15	Valve	9	8	Same
2, 8	10-4	Valve	9	8	Strip	III	10, bottom	Same
15, 8, 2, 5	11-3	Block	XIV	3	Valve	8	8	Same
8	11-4	Valve	8	8	Strip	III	11, bottom	Same
5, 8, 4	12-3	Block	XIV	14	Valve	7	8	Same
4,8	12-4	Valve	7	8	Strip	II	1, top	Same
15, 4, 10	13-3	Block	XIII	3	Valve	10	8	Same
10, 4, 8	13-4	Valve	10	8	Strip	III	9, bottom	Same
15, 4, 10	14-3	Block	XIV	9	Valve	11	8	Same
10, 4, 8	14-4	Valve	11	8	Strip	III	8, bottom	Same
15, 8, 5	15-3	Block	XIV	2	Valve	28	8	Same
8	15-4	Valve	28	8	Strip	III	7, bottom	Same
15, 8, 5	16-3	Block	XIV	12	Valve	29	8	Same
8	16-4	Valve	29	8	Strip	III	6, bottom	Same
15, 4, 8	20-4	Block	XIV	6	Same	II	3, bottom	Same
4, 8, 15	21-4	Same	XIII	22	Same	III	3, top	Same

1	2	3	4	5	6	7	8	9
15, 5	22-3	Block	XIV	7	Valve	17	3	МГВСЛ, 0.35 sq.mm
5, 8	22-4	Valve	17	3	Strip	III	5, bottom	Same
15, 13	23-3	Block	XIV	20	Valve	13	8	Same
10, 3, 8	23-4	Valve	13	8	Strip	II	4, top	Same
15, 4, 8	24-3	Block	XIV	16	Same	I	4, bottom	Same
15, 6, 8	25-3	Same	XIV	10	Same	III	1, bottom	Same
8, 6, 10	25-4	Strip	III	1, bottom	Valve	16	5	Same
15, 4, 14	26-3	Block	XIV	21	Same	19	3	Same
15, 5	27-3	Same	XIV	22	Same	18	3	Same
5, 8	27-4	Valve	18	3	Strip	III	4, bottom	Same
3, 8, 4	48-3	Capacitor	138		Valve	19	5	Same
10, 2, 8	29-3	Strip	1	5, bottom	Strip	III	2, bottom	МГВСЛЭ, 0.35 sq.mm
10, 5, 8	29-5	Valve	17	1	Same	III	2, bottom	Same
3, 8	2-16	Capacitor	138		Same	1	4, top	МГВСЛ, 0.35 sq.mm
10, 11, 14	33-3	Same	XIII	2	Valve	15	4	МГВСЛЭ, 0.35 sq.mm
15	33-4	Valve	15	4	Capacitor	130	Bottom	Same
15, 14, 9, 1	40-5	Block	XIII	1	Valve	2	1	МГВСЛ,
9, 1	40-6	Valve	2	2	Same	1	2	МГВСЛ, 1 sq.mm
9	40-7	Same	2	2	Same	4	2	МГВСЛ, 2 sq.mm
9, 10	40-8	Same	4	2	Same	3	2	МГВСЛ, 1 sq.mm
15, 14, 9	41-2	Block	XIII	12	Same	4	1	МГВСЛ, 3 sq.mm
10	41-3	Valve	4	8	Same	3	8	МГВСЛ, 1 sq.mm
10, 9, 1	41-4	Same	4	8	Same	2	8	Same

1	2	3	4	5	6	7	8	9
1	41-5	Valve	2	8	Valve	1	8	МГВСЛ, 1 sq. mm
15	48-2	Block	XIII	14	Same	19	7	МГВСЛ, 0.35 sq.mm
15, 13, 14	56-2	Same	XIII	19	Same	5	2	МГВСЛ, 1 sq.mm
15, 14	57-4	Same	XIII	8	Same	5	8	Same
15, 4, 8, 3	58-2	Same	XIII	20	Same	9	7	Same
3, 8, 4	58-3	Valve	9	7	Same	8	7	МГВСЛ, 2 sq.mm
4, 8, 5	58-4	Same	8	7	Same	7	7	МГВСЛ, 1 sq.mm
5, 8, 6	58-5	Same	7	7	Same	6	7	Same
6, 8	58-6	Same	6	7	Same	28	7	Same
15, 14	58-7	Block	XIII	20	Same	14	7	МГВСЛ, 2 sq.mm
14, 13, 10	58-8	Valve	14	7	Same	13	7	Same
10	58-9	Same	13	7	Same	11	7	МГВСЛ, 1 sq.mm
10	58-10	Same	11	7	Same	10	7	Same
10, 6, 8	58-11	Same	10	7	Same	29	7	Same
15, 14	59-2	Block	XIII	9	Same	14	8	МГВСЛ, 2 sq.mm
14, 12, 2, 10	59-3	Valve	14	8	Same	13	2	Same
2, 10, 3	59-4	Same	13	2	Same	11	2	Same
3, 10, 4	59-5	Same	11	2	Same	10	2	МГВСЛ, 1 sq.mm
4, 8, 6	59-6	Same	10	2	Same	29	2	Same
6, 8	59-7	Same	29	2	Strip	1	2, bottom	МГВСЛ, 0.35 sq.mm
15, 4, 8, 2	59-8	Block	XIII	9	Valve	9	2	МГВСЛ, 2 sq.mm
2, 8, 3	59-9	Valve	9	2	Same	8	2	Same

SECRET

1	2	3	4	5	6	7	8	9
3, 8, 4	59-10	Valve	8	2	Valve	7	2	МГВСЛ, 1 sq.mm
4, 8, 5	59-11	Same	7	2	Same	6	2	Same
5, 8, 7	59-12	Same	6	2	Same	28	2	Same
15, 4, 10	60-2	Block	XIV	1	Same	5	4	МГВСЛ, 0.35 sq.mm
15, 4, 14	61-2	Same	XIII	11	Same	5	6	Same
14, 10, 15, 13, 2	62-2	Same	XIII	7	Same	3	4	Same
	62-3	Valve	3	4	Same	4	4	Same
15, 8, 2, 5	63-2	Block	XIV	4	Same	1	4	Same
	63-3	Valve	1	4	Same	2	4	Same
15, 5, 10, 4	65-7	Block	XIV	19	Same	10	3	Same
4, 10, 3	65-8	Valve	10	3	Same	11	3	Same
3, 8, 2	65-9	Same	11	3	Same	9	3	Same
2, 8, 3	65-11	Same	9	3	Same	8	3	Same
3, 8, 4	65-12	Same	8	3	Same	7	3	Same
4, 8, 5	65-13	Same	7	3	Same	6	3	Same
5, 8, 7	65-14	Same	6	3	Same	28	3	Same
7, 8, 6	65-15	Same	28	3	Same	29	3	Same
8, 6	73-1	Strip	I	10, top	Same	18	5	МГВСЛЭ, 0.35 sq.mm
15, 5	66-2	Block	XIV	8	Same	12	5	МГВСЛ, 0.35 sq.mm
15, 14, 12	67-3	Same	XIV	5	Same	16	6	Same
12, 14, 11	67-4	Valve	16	6	Same	15	6	Same
11, 10, 2, 8	67-5	Same	15	6	Strip	I	2, top	Same
8, 6	72-1	Same	17	6	Same	I	1, bottom	Same
8, 6	67-8	Capacitor	136	2	Same	I	2, top	Same
8, 6	72-3	Strip	I	9, top	Valve	18	4	МГВСЛЭ, 0.35 sq.mm
8	68-1	Same	I	3, bottom	Strip	II	5, bottom	МГВСЛ, 0.35 sq.mm
8, 3	68-2	Same	I	3, bottom	Valve	9	6	Same
3, 8, 4	68-3	Valve	9	6	Same	8	6	Same

SECRET

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SECRET

1	2	3	4	5	6	7	8	9
4, 8, 5	68-4	Valve	8	6	Valve	7	6	МГВСЛ, 0.35 sq.mm
5, 8, 6	68-5	Same	7	6	Valve	6	6	Same
6, 8	68-6	Same	6	6	Same	28	6	Same
8, 7	68-7	Same	28	6	Same	29	6	Same
7, 8, 4	68-8	Same	29	6	Same	12	3	Same
4	68-9	Same	12	3	Same	11	6	Same
4, 10, 5	68-10	Same	11	6	Same	10	6	Same
10, 14, 12, 2, 8	69-1	Same	16	8	Strip	I	7, bottom	Same
14	69-2	Same	16	8	Valve	14	1	Same
10, 13, 2, 8	70-1	Same	14	6	Strip	I	6, top	Same
13, 10, 5, 8	70-2	Same	14	6	Same	III	2, top	Same
3, 8	71-1	Same	13	6	Same	I	8, bottom	Same
10, 2, 8, 12, 14	71-2	Strip	I	8, bottom	Valve	15	8	Same
8, 2, 13, 15	71-3	Same	I	11, top	Block	XIII	4	Same
8, 2, 13, 15	71-4	Same	I	11, bottom	Same	XIII	13	Same
14, 6, 8	26-4	Same	III	1, top	Valve	19	3	Same

SECRET

WIRE TABLE TO WIRING DIAGRAM No.3 OF SUPPLY UNIT БП-02
(Fig.31)

No. of wire bundle	No. of wire	From: Part	From: Ref. No. in key diagram	From: No. of contact	To: Part	To: Ref. No. in key diagram	To: No. of contact	Type and cross-section of wire
1	2	3	4	5	6	7	8	9
1	0-31	Block	XVI	12	Earth lug	Beside 150		МГВСЛ, 1 sq.mm
4	0-32	Same	VIII	2, short	Same	Beside 21		МГВСЛ, 0.35 sq.mm
3, 4	0-33	Same	VIII	2, short	Block	VIII	3, long	Same
4, 8, 1	0-34	Earth lug	Beside 21		Earth lug	Beside 150		Same
4	0-35	Lighting lamp	21	1	Same	Beside 21		Same
4	0-36	Same	20	1	Same	Beside 21		Same
1	0-37	Block	VII	2, long	Same	Beside 150		Same
6, 8, 1	0-38	Earth lug	Beside 110		Same	Beside 150		Same
4	1-1	Block	XV	12	Block	VIII	12, short	Same
1, 2	2-1	Same	VII	3, long	Same	VII	13, short	Same
2	2-2	Same	VII	13, short	Same	XVI	13	Same
1	3-1	Same	XVI	9	Button	152	1	Same
4	4-1	Same	XV	2	Lighting lamp	21	2	Same

1	2	3	4	5	6	7	8	9
4	5-1	Block	XV	1	Lighting lamp	20	2	МГВСЛ, 0.35 sq.mm
1	6-1	Same	XVI	20	Block	VII	12, long	Same
2	7-1	Same	XVI	14	Same	VII	2, short	Same
1	8-1	Same	XVI	7	Same	VII	9, long	Same
3	9-1	Same	XV	16	Same	VIII	5, long	Same
3	10-1	Same	XV	6	Same	VIII	8, long	Same
3	11-1	Same	XV	17	Same	VIII	7, long	Same
3	12-1	Same	XV	7	Same	VIII	6, long	Same
3	13-1	Block	XV	18	Same	VIII	9, long	Same
3	14-1	Same	XV	8	Same	VIII	10, long	Same
3	15-1	Block	XV	19	Same	VIII	11, long	Same
3	16-1	Same	XV	9	Same	VIII	12, long	Same
3	71-6	Same	XV	20	Same	VIII	4, long	Same
4	18-1	Same	XV	3	Same	VIII	3, short	Same
3	19-1	Same	XV	14	Same	VIII	2, long	Same
2	20-1	Same	XVI	4	Same	VII	10, short	Same
2	21-1	Same	XVI	15	Same	VII	3, short	Same
2	22-1	Same	XVI	5	Same	VII	11, short	Same
1	23-1	Same	XVI	10	Same	VII	10, long	Same
1	24-1	Same	XVI	21	Same	VII	13, long	Same
1	25-1	Same	XVI	18	Same	VII	14, long	Same
2	26-1	Same	XVI	6	Same	VII	14, short	Same
2	27-1	Same	XVI	16	Same	VII	12, short	Same
3, 8, 7	71-8	Same	XV	15	Same	VIII	4, short	Same
3, 8, 6	72-1	Same	XV	10	Potentiometer	110	1	Same
4, 8, 6	73-16	Same	XV	21	Same	110	3	Same
3, 8, 6	33-1	Same	XVI	2	Same	110	2	Same
1	34-1	Button	151	2	Button	152	2	Same
3, 8, 1	34-2	Same	151	2	Block	XV	1	Same
1	35-1	Same	150	1	Button	151	1	Same
1	35-2	Same	151	11	Block	XVI	11	Same
5, 8, 1	36-1		181	1	Button	150	2	Same

1	2	3	4	5	6	7	8	9
2, 5	A ан-2	Block	XVI	8		182	2	МГВСЛ, 1 sq.mm
2, 5	A' ан-5	Same	XVI	22	Same	182	1	Same
2, 8	B-2	Same	XVI	19	Same	180	1	Same
8, 1	B-5		180	2	Jack	190	2	Same
1	C-2	Block	XVI	17	Same	190	1	Same
2, 5	C-5	Same	XVI	3		181	2	МГВСЛ, 0.35 sq.mm

WIRE TABLE TO WIRING DIAGRAM No.4 OF SUPPLY UNIT БП-02
(Fig.32)

No. of wire bundle	No. of wire	From			To			Type and cross-section of wire
		Part	Ref. No. in key diagram	No. of contact	Part	Ref. No. in key diagram	No. of contact	
1	2	3	4	5	6	7	8	9
10	3-2	Block	XI	9	Block	V	5	МГВСЛ, 0.35 sq.mm
10	3-3	Same	V	5	Connector	1019	9	Same
1, 2, 3	3-4	Same	V	5	Anode voltage circuit breaker	156	8	Same
10	34-3	Same	XV	1	Block	V	4	Same
1, 2, 3	34-4	Same	V	4	Auxiliary relay	155	10	Same
1	34-5	Same	V	4	Heater voltage circuit breaker	153	9	Same
1	34-6	Heater voltage circuit breaker	153	9	Same	153	10	Same
1, 2, 3	34-7	Same	153	10	Anode voltage circuit breaker	156	9	Same
3	34-8	Auxiliary relay	155	10	Thermal relay	154	2	Same
10	35-3	Block	XVI	11	Block	V	3	Same
1	35-4	Same	V	3	Heater voltage circuit breaker	153	8	Same
10	53-1	Connector	1019	7	Block	V	6	Same

1	2	3	4	5	6	7	8	9
1, 2, 3	53-2	Block	V	6	Anode voltage circuit breaker	156	10	МГВСЛ, 0.35 sq.mm
10	C-1	Connector	1021	7	Block	VI	3	МГВСЛ, 1 sq.mm
10	C-3	Block	XVI	17	Same	VI	3	Same
1, 2	C-4	Same	VI	3	Heater voltage circuit breaker	153	3	Same
10	C-6	Same	XVI	3	Block	V	7	МГВСЛ, 0.35 sq.mm
1	C-7	Same	V	7	Same	VI	3	Same
10	C нак-1	Connector	1019	14	Same	VI	6	Same
10	C нак-2	Block	VI	6	Same	X	1	Same
1, 2, 3	C нак-3	Same	VI	6	Heater voltage circuit breaker	153	6	МГВСЛ,
10	A-1	Connector	1021	3	Block	VI	1	МГВСЛ, 2 sq.mm
1, 2	A-2	Block	VI	1	Heater voltage circuit breaker	153	1	Same
2, 3, 5	A-3	Heater voltage circuit breaker	153	1	Anode voltage circuit breaker	156	1	МГВСЛ, 1 sq.mm
1	A-4	Block	VI	1	Auxiliary relay	155	6	МГВСЛ, 0.35 sq.mm
1	A-5	Auxiliary relay	155	6	Same	155	3	Same
1	A-6	Same	155	3	Same	155	1	Same
1, 2, 3	A-7	Same	155	1	Heater voltage circuit breaker	153	14	Same
3	A-8	Heater voltage circuit breaker	153	14	Auxiliary relay	155	13	Same
10	A ан-1	Connector	1019	6	Block	VI	7	МГВСЛ, 1 sq.mm
10	A ан-3	Block	VI	7	Same	XVI	8	Same
1, 2, 3, 4	A ан-4	Same	VI	7	Anode voltage circuit breaker	156	4	Same

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1	2	3	4	5	6	7	8	9
10	A нак-4	Transformer	141	2	Block	VI	4	МГВСЛ, 1 sq.mm
1, 2, 3	A нак-6	Block	VI	4	Heater voltage circuit breaker	153	4	Same
10	B-1	Connector	1021	5	Block	VI	2	МГВСЛ, 2 sq.mm
10	B-3	Block	XVI	19	Same	VI	2	Same
1, 2	B-4	Same	VI	2	Heater voltage circuit breaker	153	2	Same
2, 3, 5	B-5	Heater voltage circuit breaker	153	2	Anode voltage circuit breaker	156	2	МГВСЛ, 1 sq.mm
10	B ан-2	Transformer	140	2	Block	VI	8	МГВСЛ, 2 sq.mm
1, 2, 3, 4	B ан-3	Block	VI	8	Anode voltage circuit breaker	156	5	МГВСЛ, 1 sq.mm
10	B нак-4	Transformer	141	1	Block	VI	5	Same
1, 2, 3, 5	B нак-6	Block	VI	5	Heater voltage circuit breaker	153	5	Same
3	73-1	Thermal relay	154	3	Resistor	39	1	МГВСЛ, 0.35 sq.mm
3	74-1	Auxiliary relay	155	8	Thermal relay	154	1	Same
3	74-2	Same	155	8	Auxiliary relay	155	9	Same
3	75-1	Resistor	39	2	Same	155	7	Same
1, 2, 3, 5	76-1	Auxiliary relay	155	2	Anode voltage circuit breaker	156	14	Same
10	54-1	Connector	1019	5	Block	5	1	МГВСЛЭ, 0.35 sq.mm
10	55-1	Same	1019	4	Same	5	2	Same

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WIRE TABLE TO WIRING DIAGRAM OF CONTROL PANEL (UNIT ПУ-03)
(Fig.33)

No. of wire bundle	No. of wire	From: Part	From: Ref. No. in key diagram	From: No. of contact	To: Part	To: Ref. No. in key diagram	To: No. of contact	Type and cross-section of wire
1	2	3	4	5	6	7	8	9
	1-1	Adapter	1105	5	Jack	ГН-1		ЛПРГС,
	1-2	Jack	ГН-1		Receptacle	РШ-1	1	1.5 sq.mm
	1-3	Receptacle	РШ-1	1	Transformer	Тр-1	3	Same
	2-1	Adapter	1105	6	Jack	ГН-2		Same
	2-2	Jack	ГН-2		Receptacle	РШ-1	2	Same
	2-3	Receptacle	РШ-1	2	Transformer	Тр-1	5	Same
	3-1	Adapter	1105	7	Same	Тр-1	2	ЛПРГС,
	3-2	Same	1105	7	Fuse	Пр-2		1 sq.mm
	4-1	Same	1105	8	Same	Пр-1		Same
	4-2	Same	1105	8	Switch	Т-1		Same
	5-1	Same	1105	9	Same	Т-1		Same
	6-1	Same	1105	10	Fuse	Пр-2		Same
	7-1	Same	1105	11	Same	Пр-3		Same
	8-1	Same	1105	12	Same	Пр-4		Same
	9-1	Fuse	Пр-4		Switch	Т-1		Same
	10-1	Same	Пр-3		Same	Т-1		Same
	11-1	Same	Пр-1		Transformer	Тр-1	1	Same

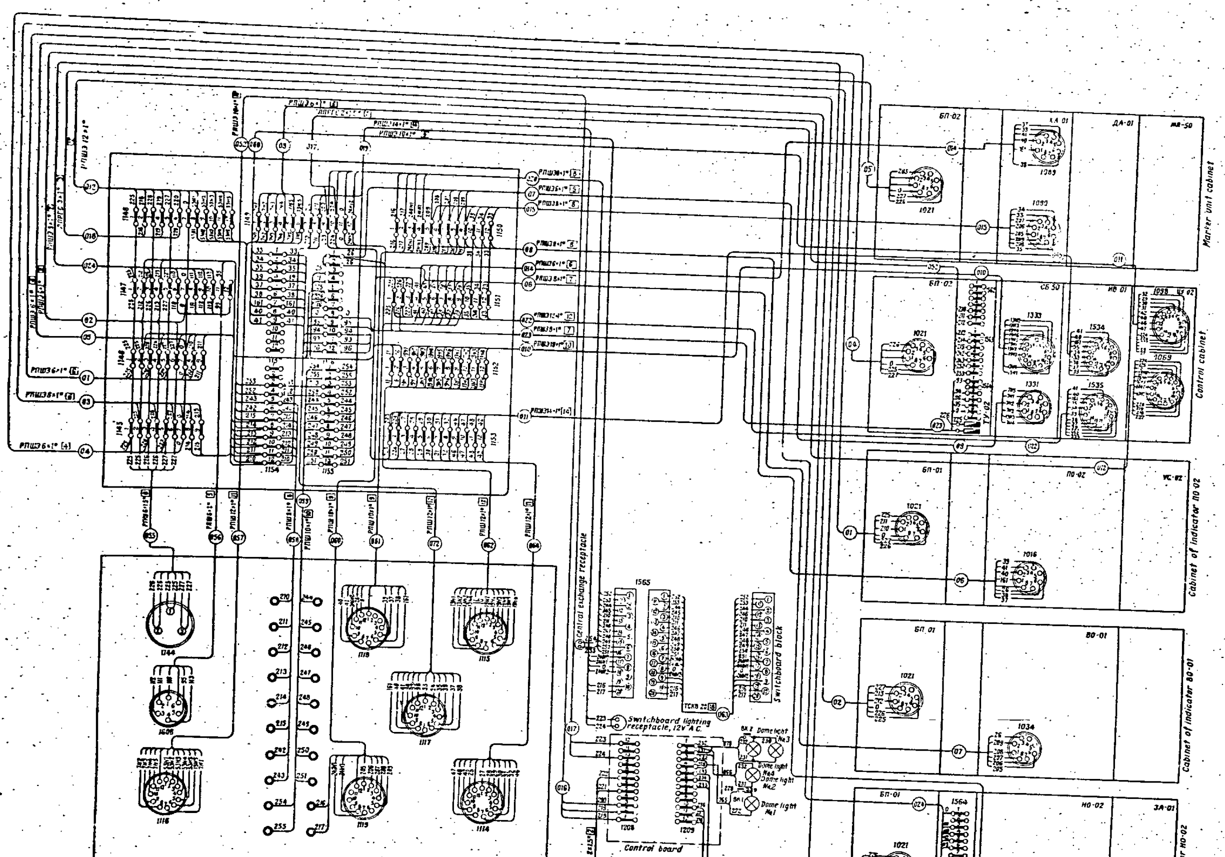

Fig.1. Connection Diagram of Truck № 2 (Audio-Frequency Connections).

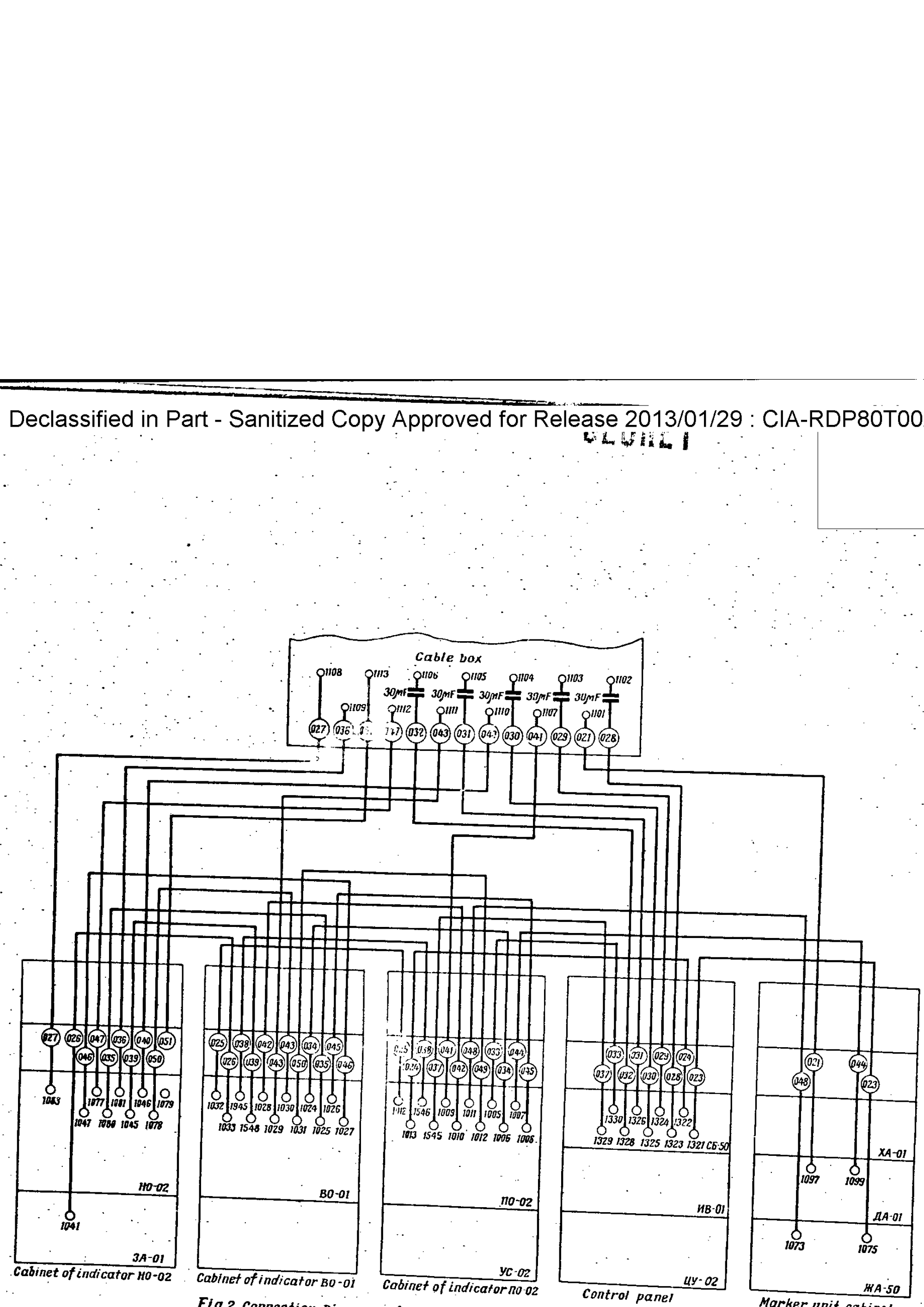

Fig.2. Connection Diagram of Truck №2. (Radio-Frequency Connections)

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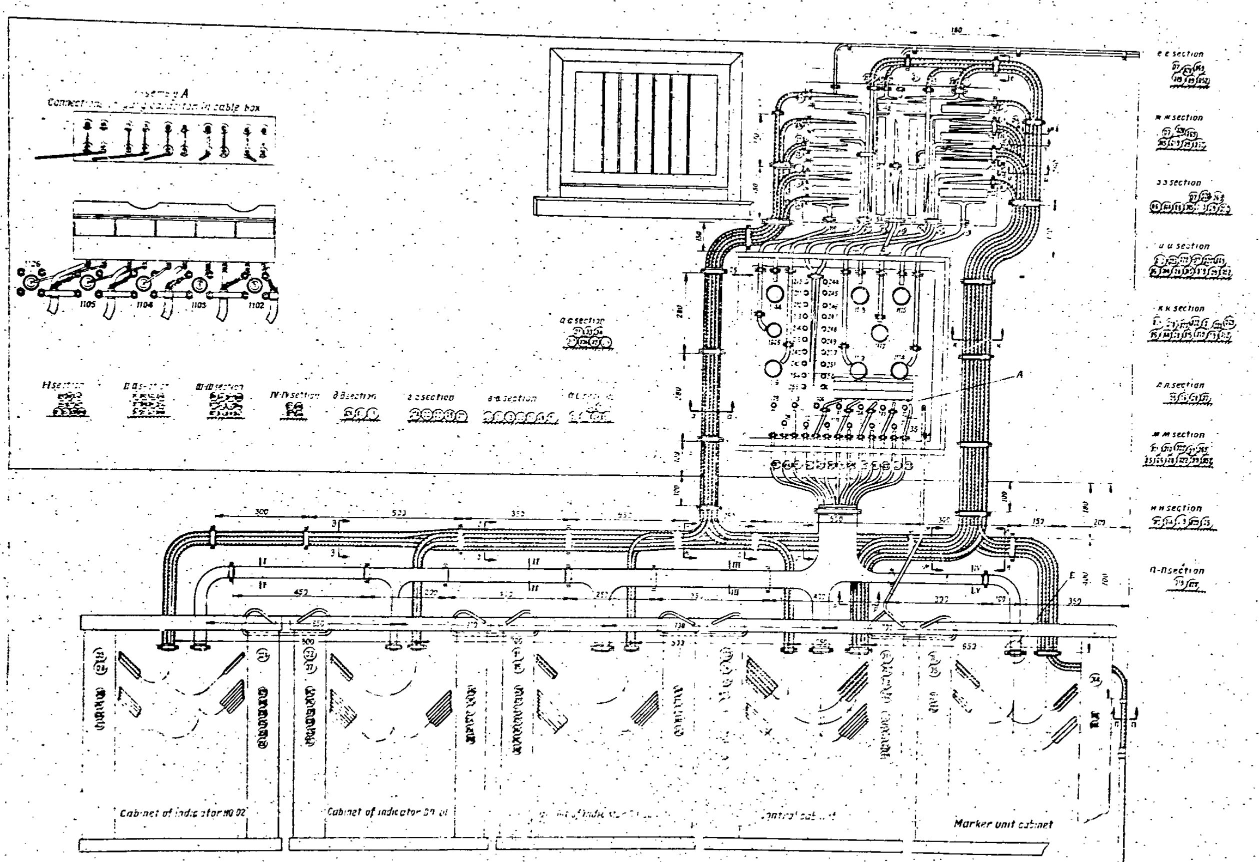

Fig.3. Cabling Diagram of Truck No 2

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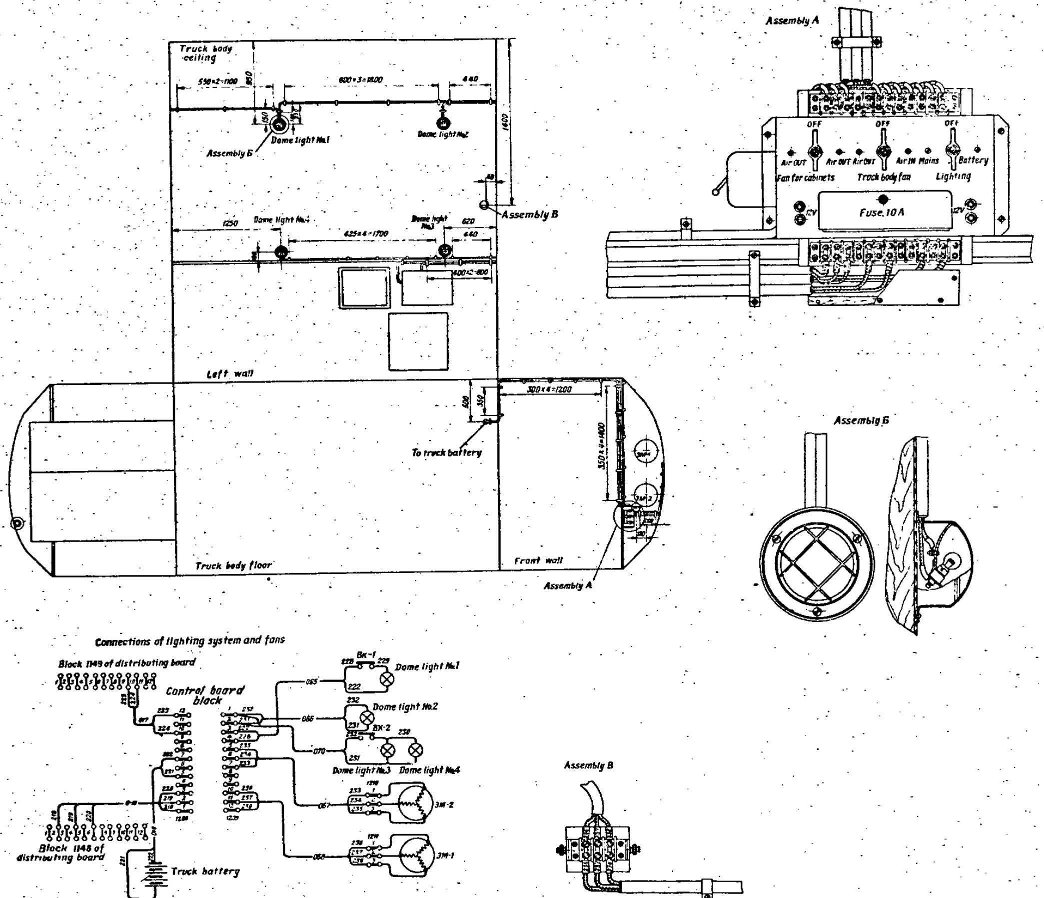

Fig.4. Wiring Diagram of Truck №2 (Lighting and Fan Supply)

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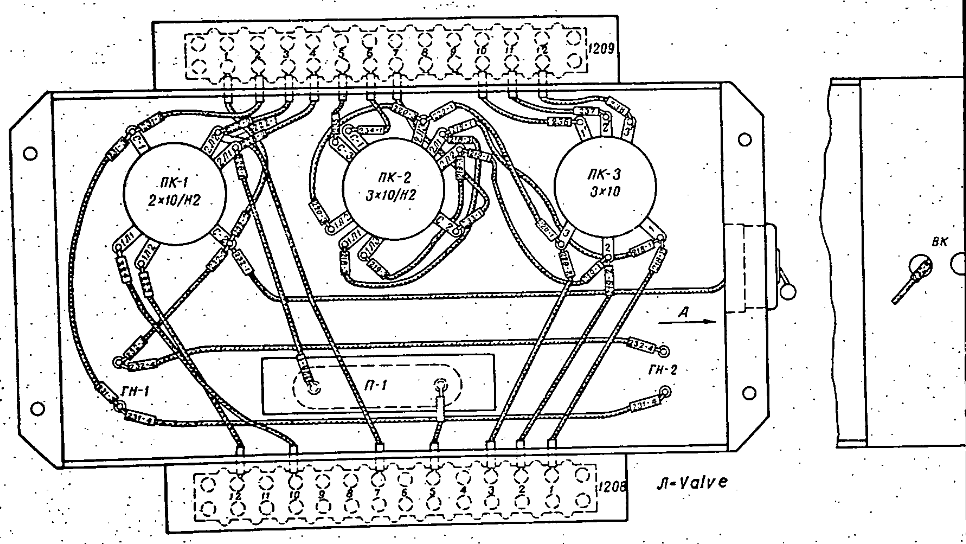

Fig. 5. Wiring Diagram of Control Panel

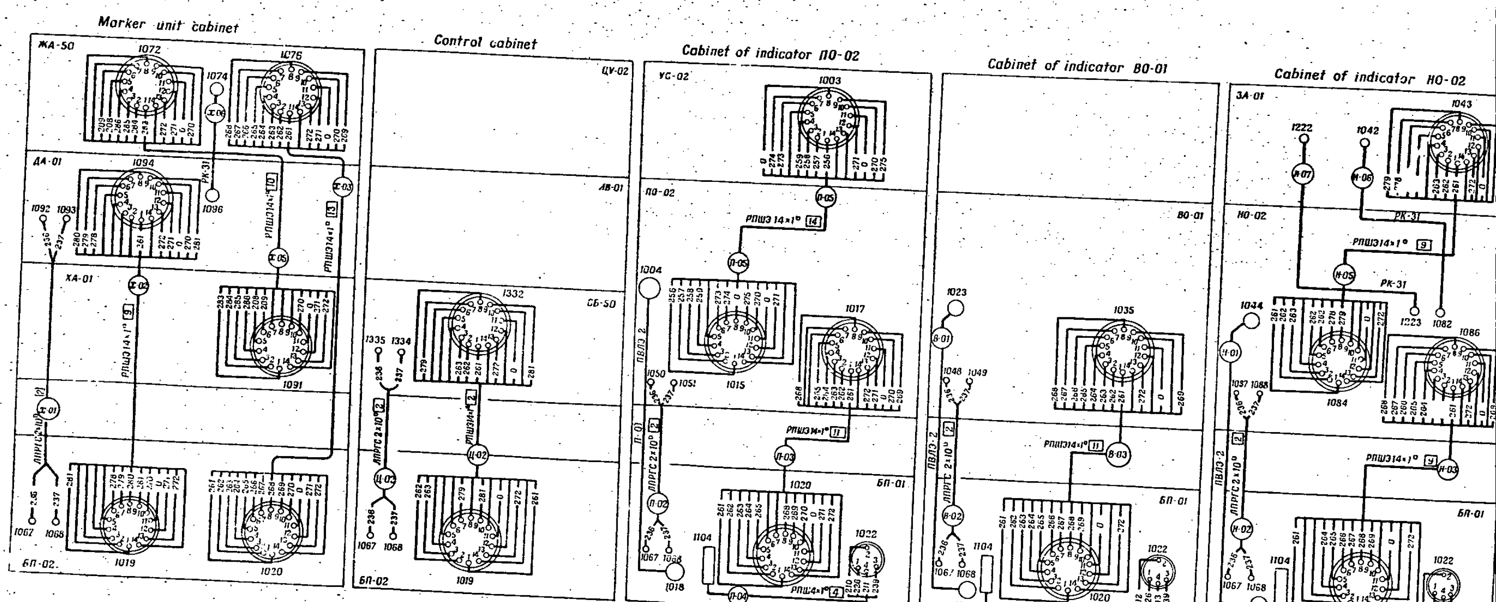

Fig. 6. Connection Diagram of Cabinets of Truck No. 2 (Interconnections of Units)

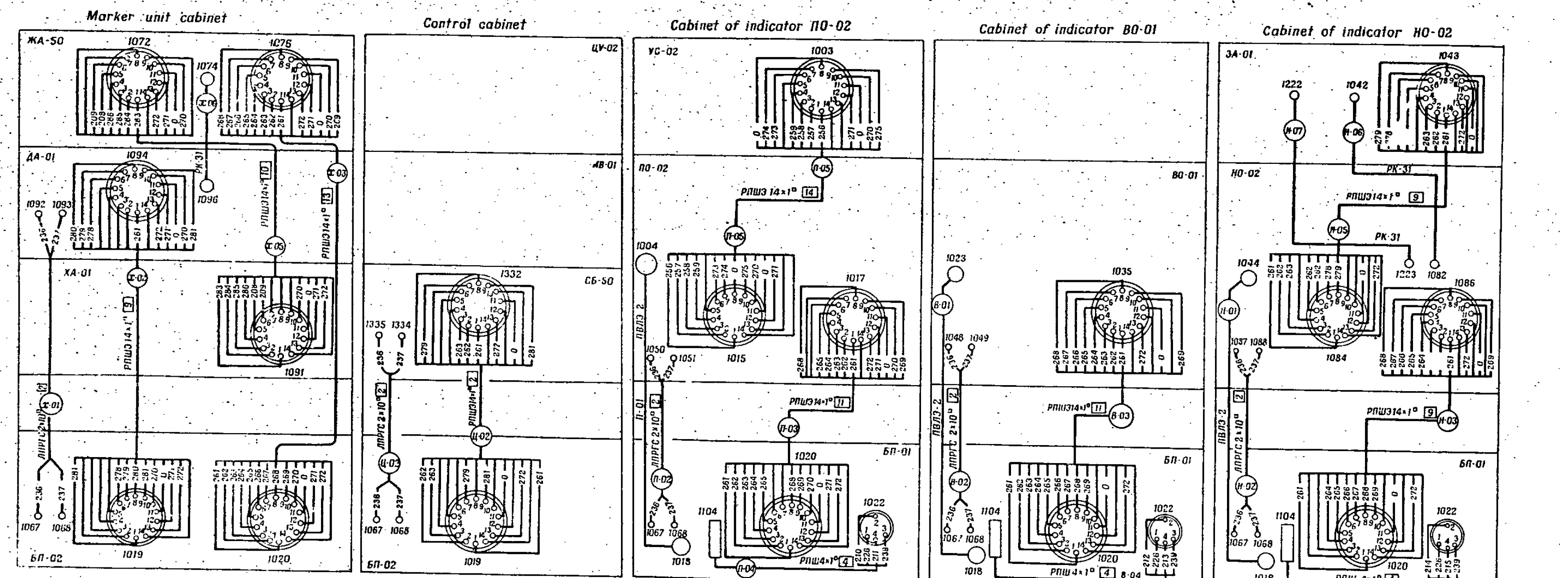

Fig. 6. Connection Diagram of Cabinets of Truck No. 2 (Interconnections of Units)

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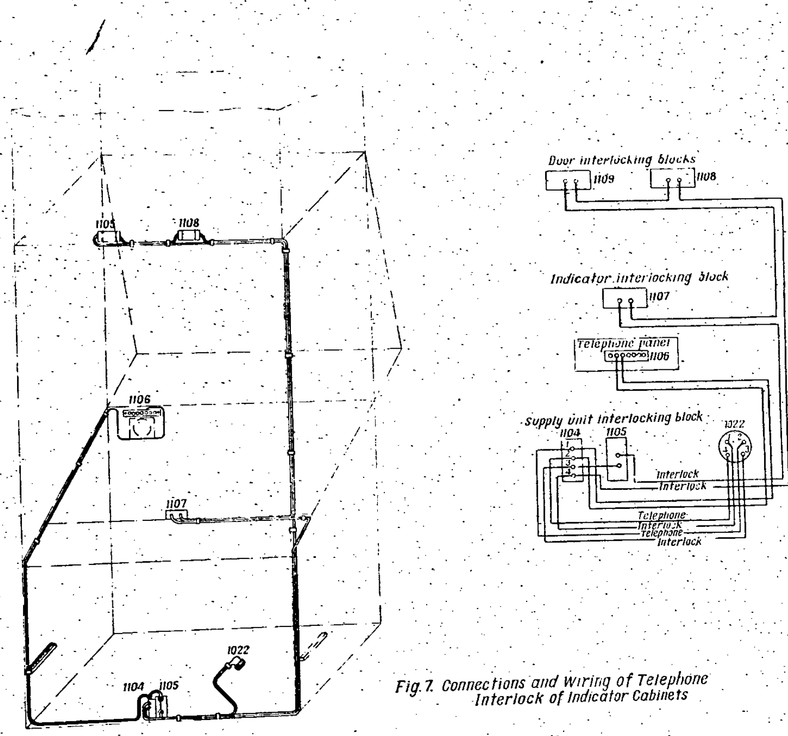

Fig. 7. Connections and wiring of Telephone Interlock of Indicator Cabinets

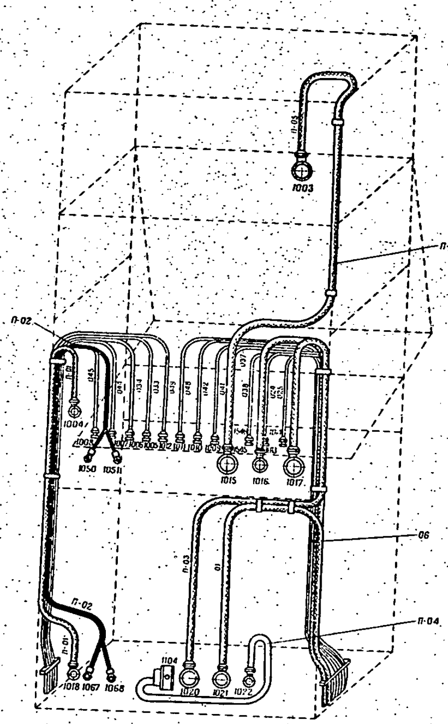

Fig. 8. Wiring Diagram of Indicator Cabinet ПО-02

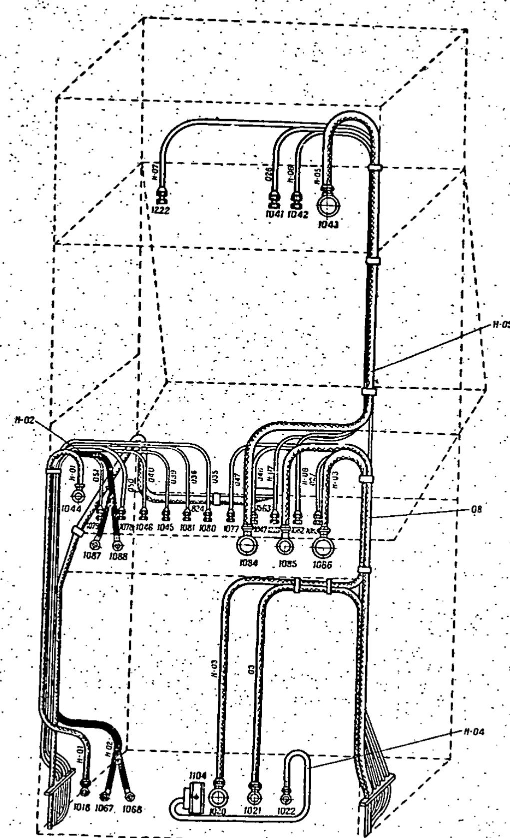

Fig. 9. Wiring Diagram of Indicator Cabinet НО-02

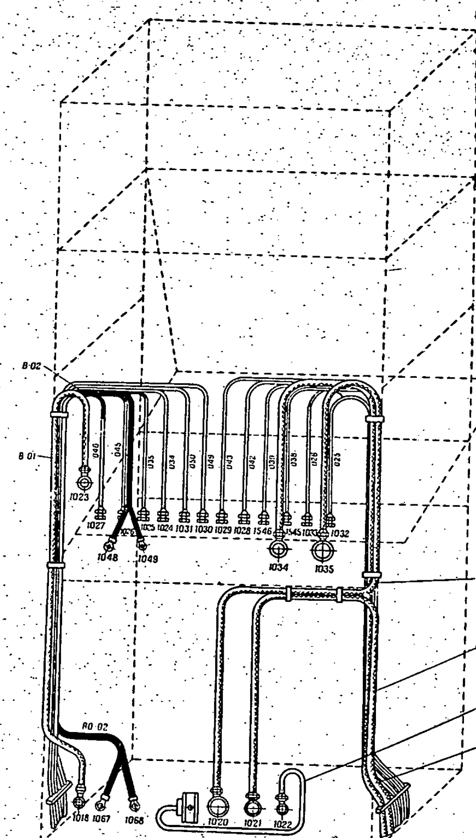

Fig. 10. Wiring Diagram of Indicator Cabinet ВО-01

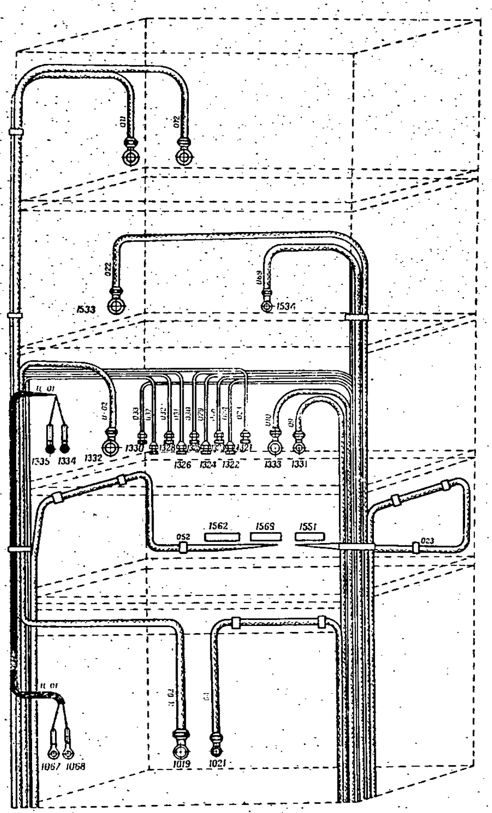

Fig. 11. Wiring Diagram of Control Cabinet

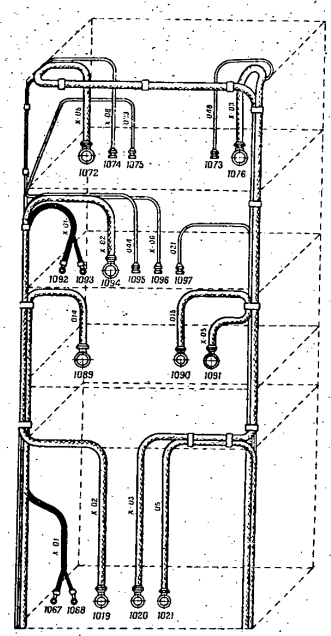

Fig. 12. Wiring Diagram of Marker Unit Cabinet

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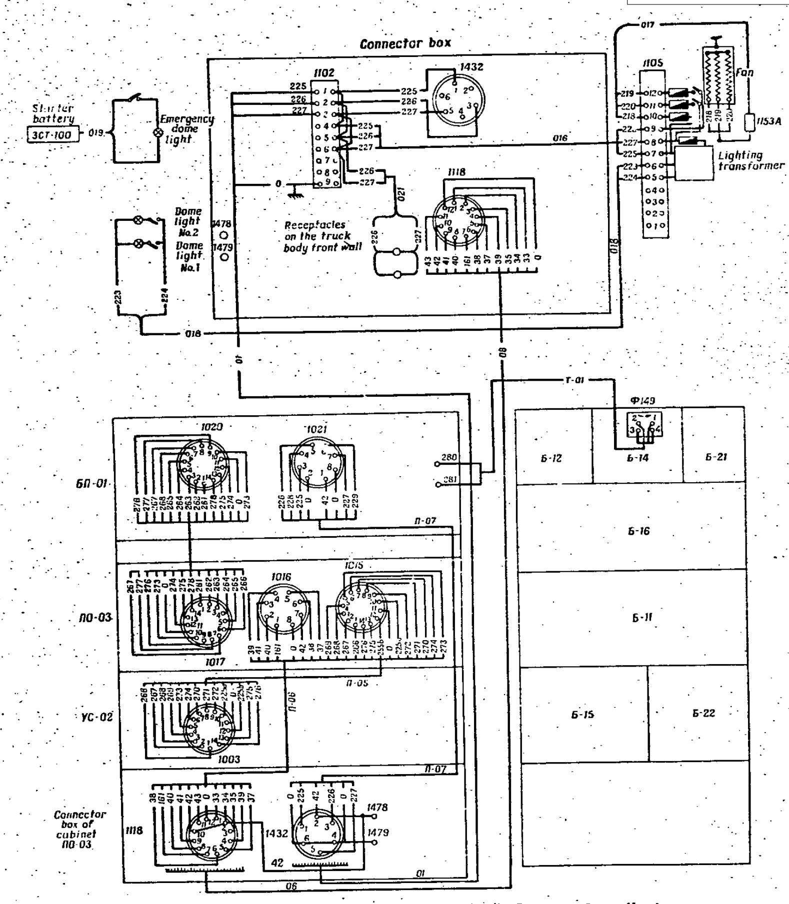

Fig. 13. Connection Diagram of Truck No. 3 (Audio-Frequency Connections)

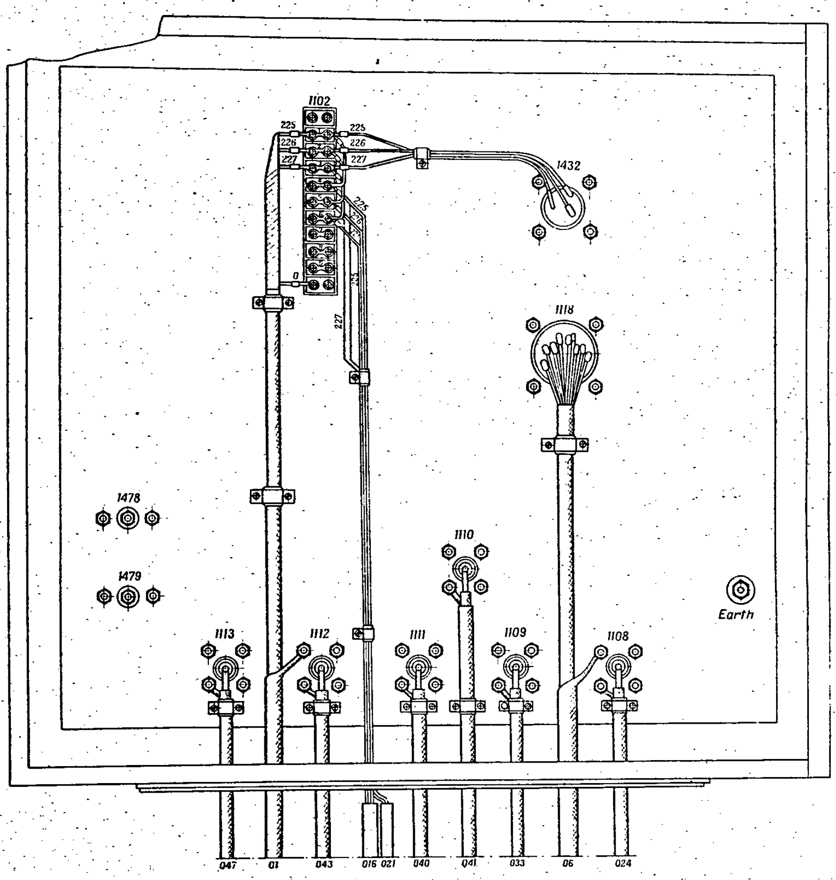

Fig. 14. Wiring Diagram of Truck No.3 (Connections in Cable Box)

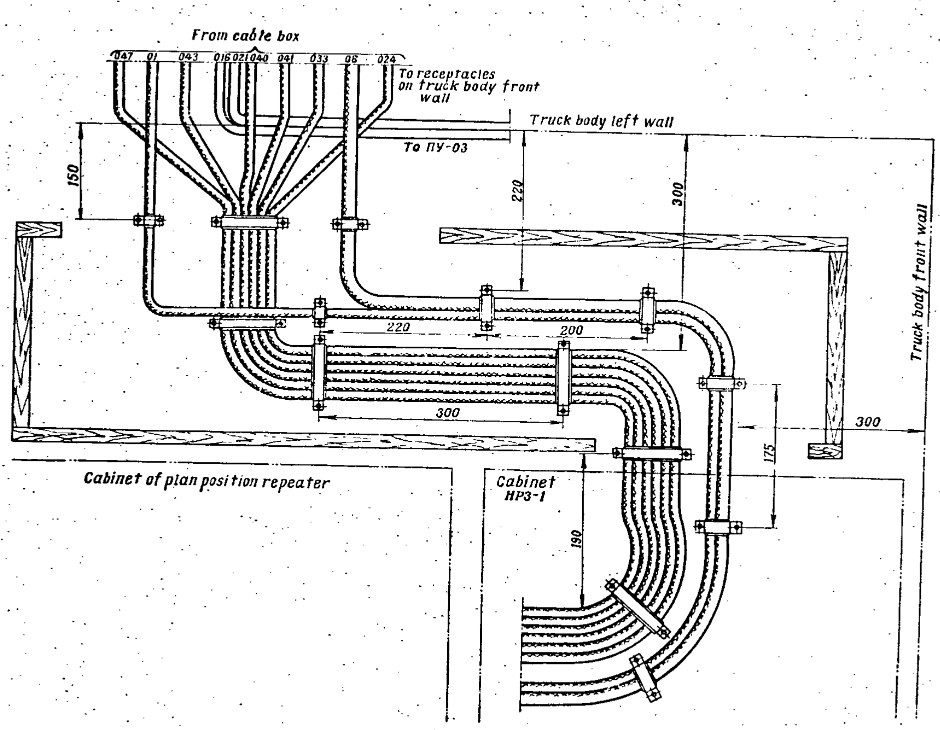

Fig. 15. Wiring Diagram of Truck №.3 (Cable Connections)

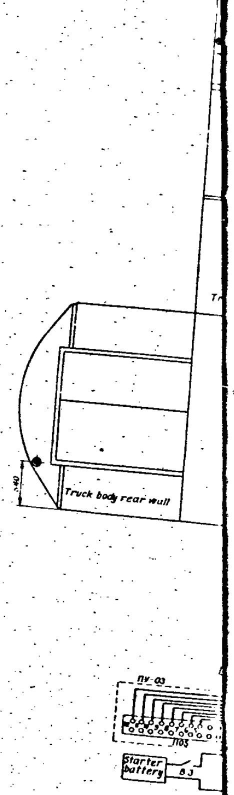

Fig. 16. Wiring

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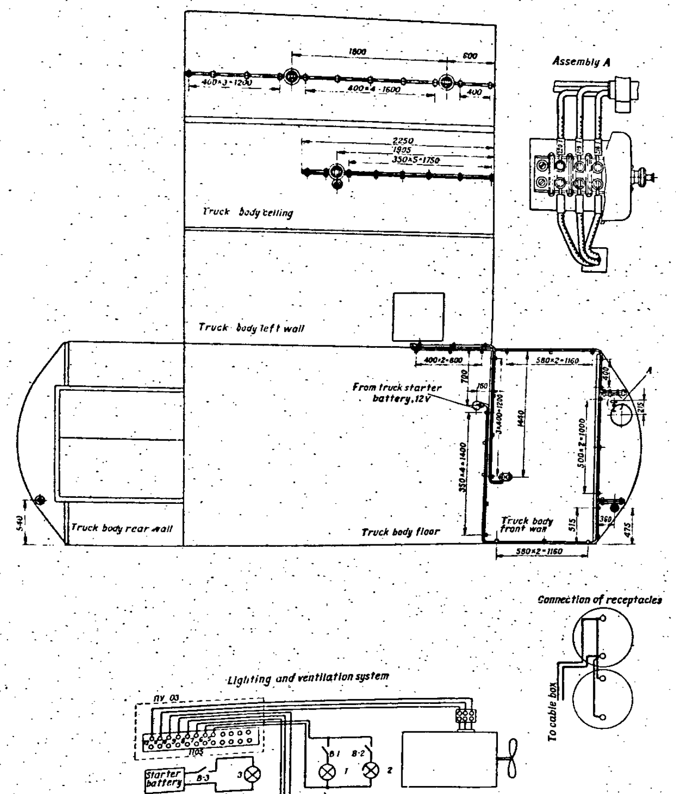


Fig. 16. Wiring Diagram of Truck № 3 (Lighting)

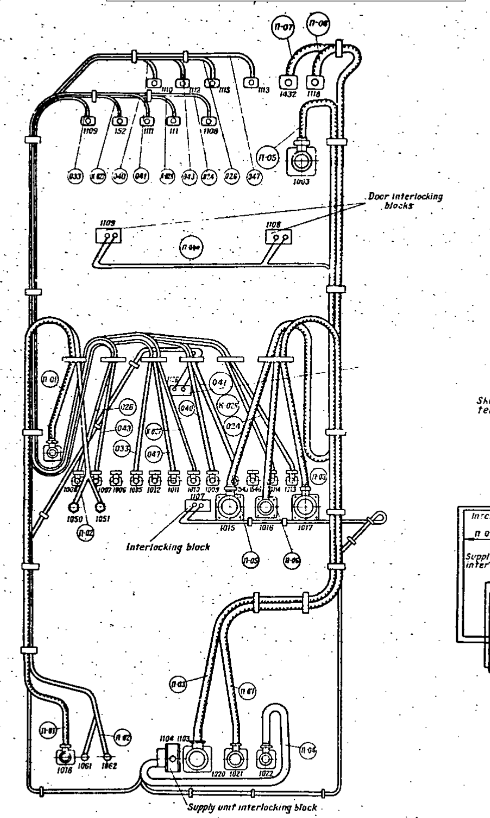


Fig. 17. Wiring Diagram of Indicator Cabinet ПО-03

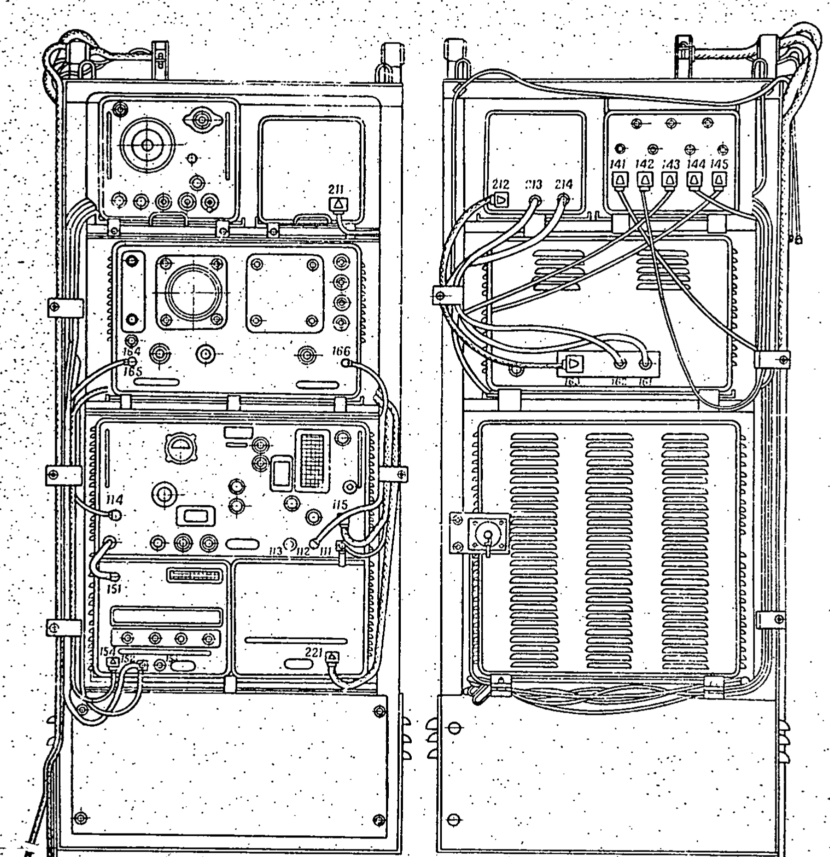
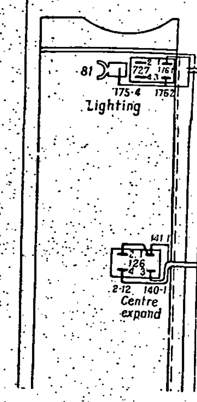


Fig. 18. Wiring Diagram of Interrogator Cabinet HP3-1



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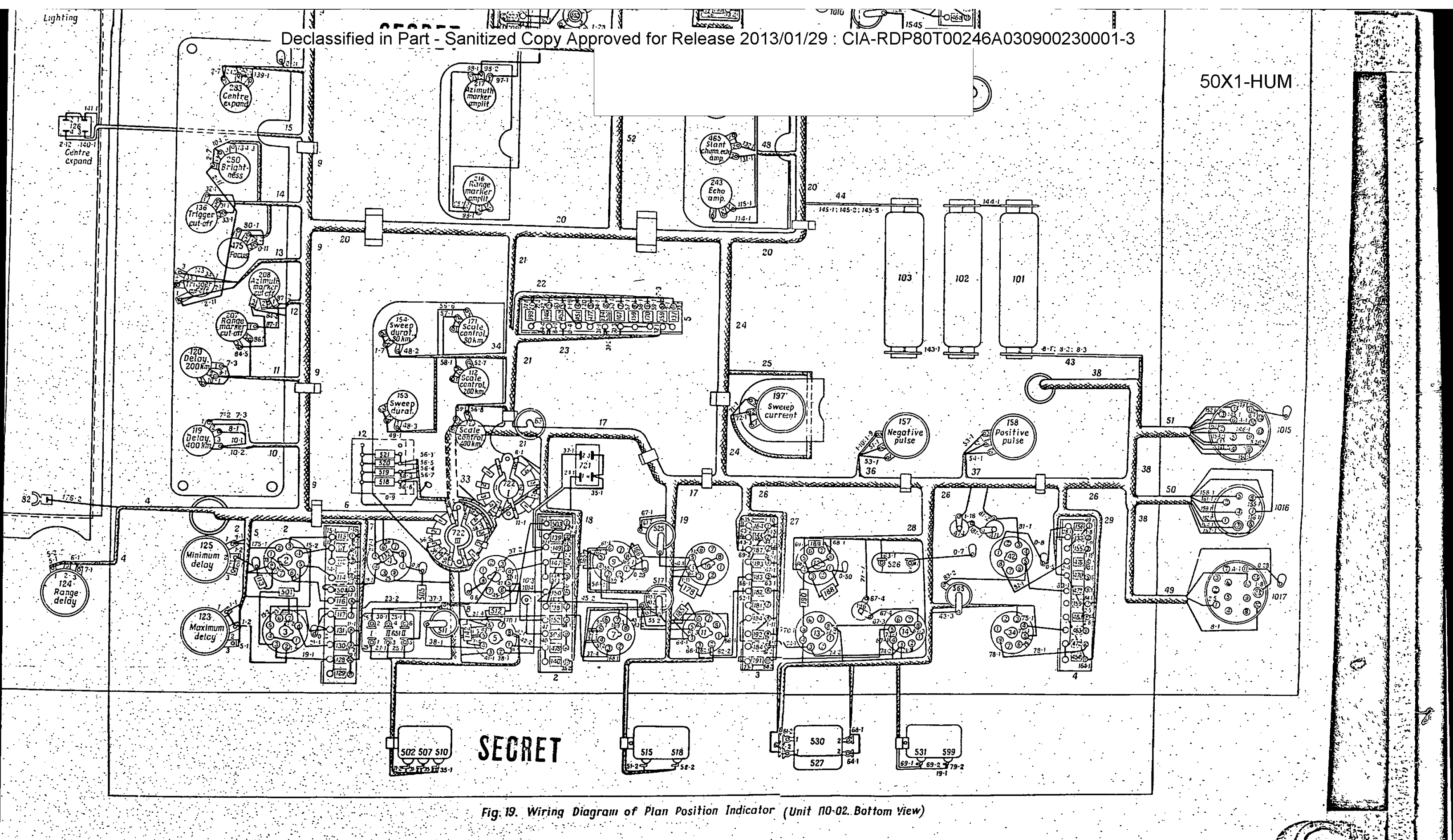

Fig. 19. Wiring Diagram of Plan Position Indicator (Unit 110-02. Bottom View)

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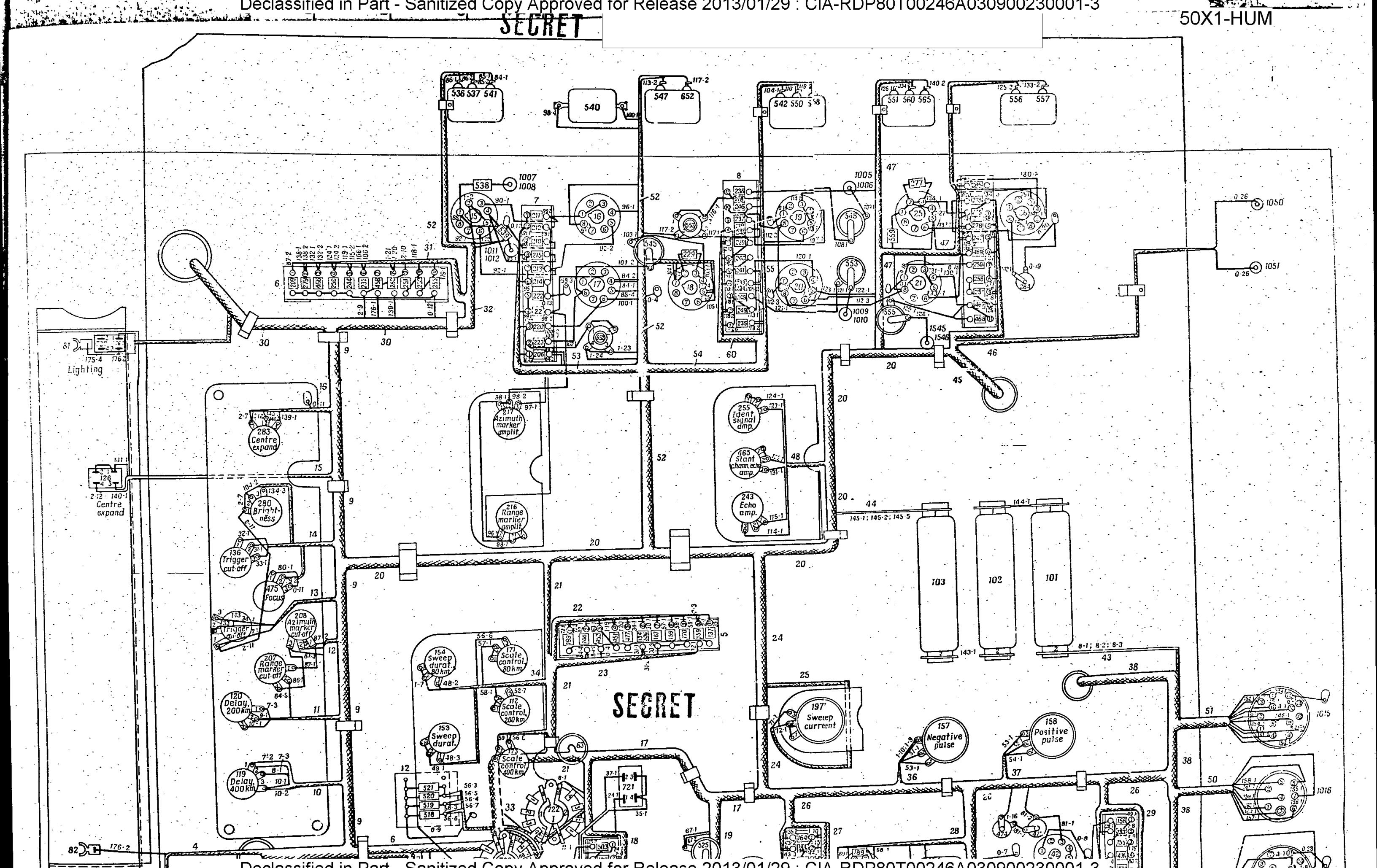


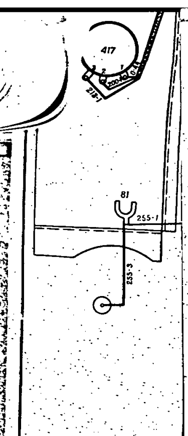


Fig. 21: Wiring Diagram of Height Indicator (Unit HO-02. Bottom View)

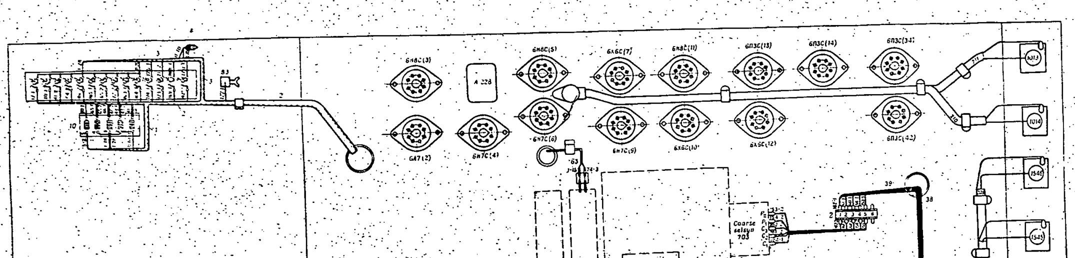
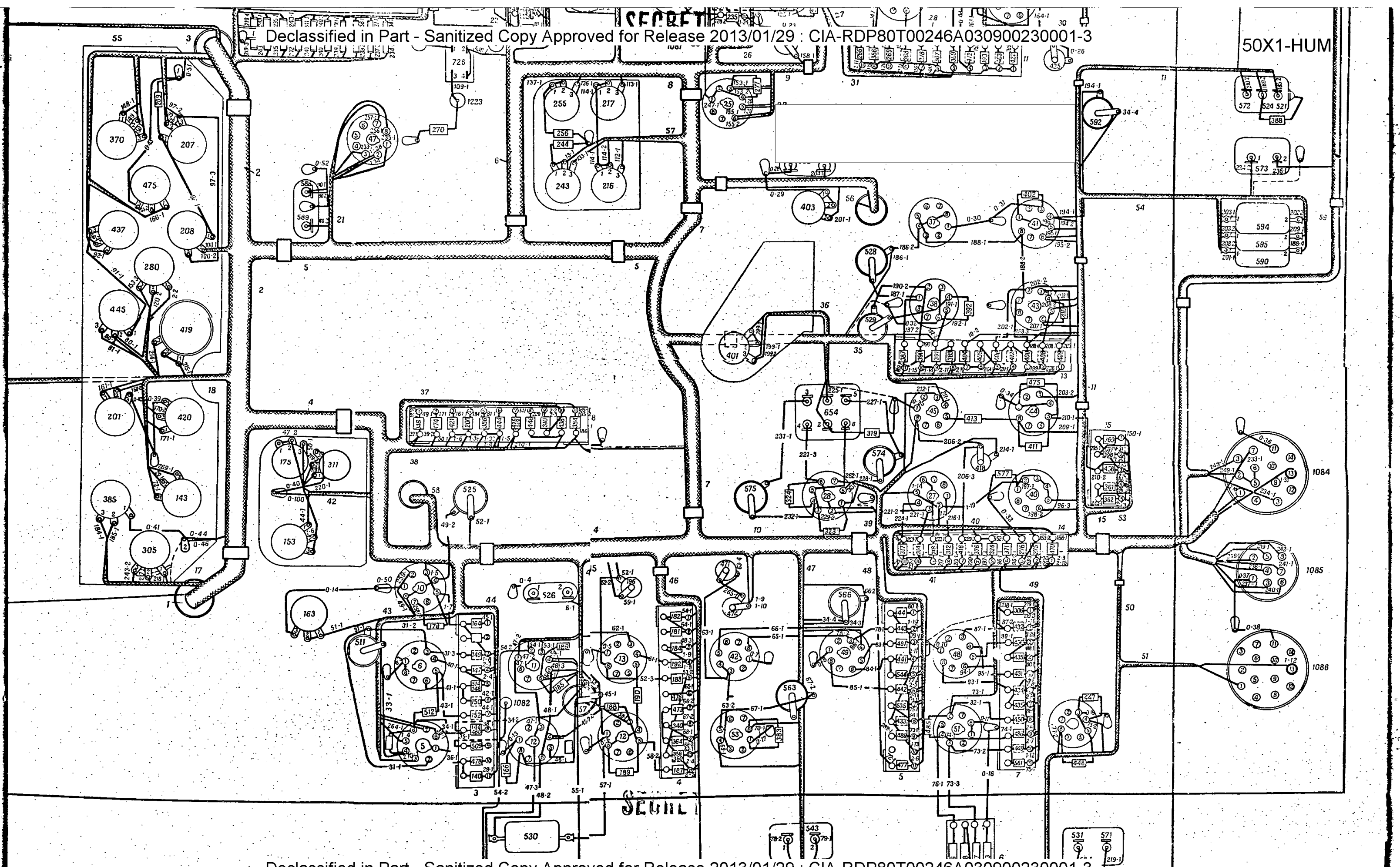


Fig. 20. Wiring Diagram of Plan Position Indicator (Unit HO-02, Top View)



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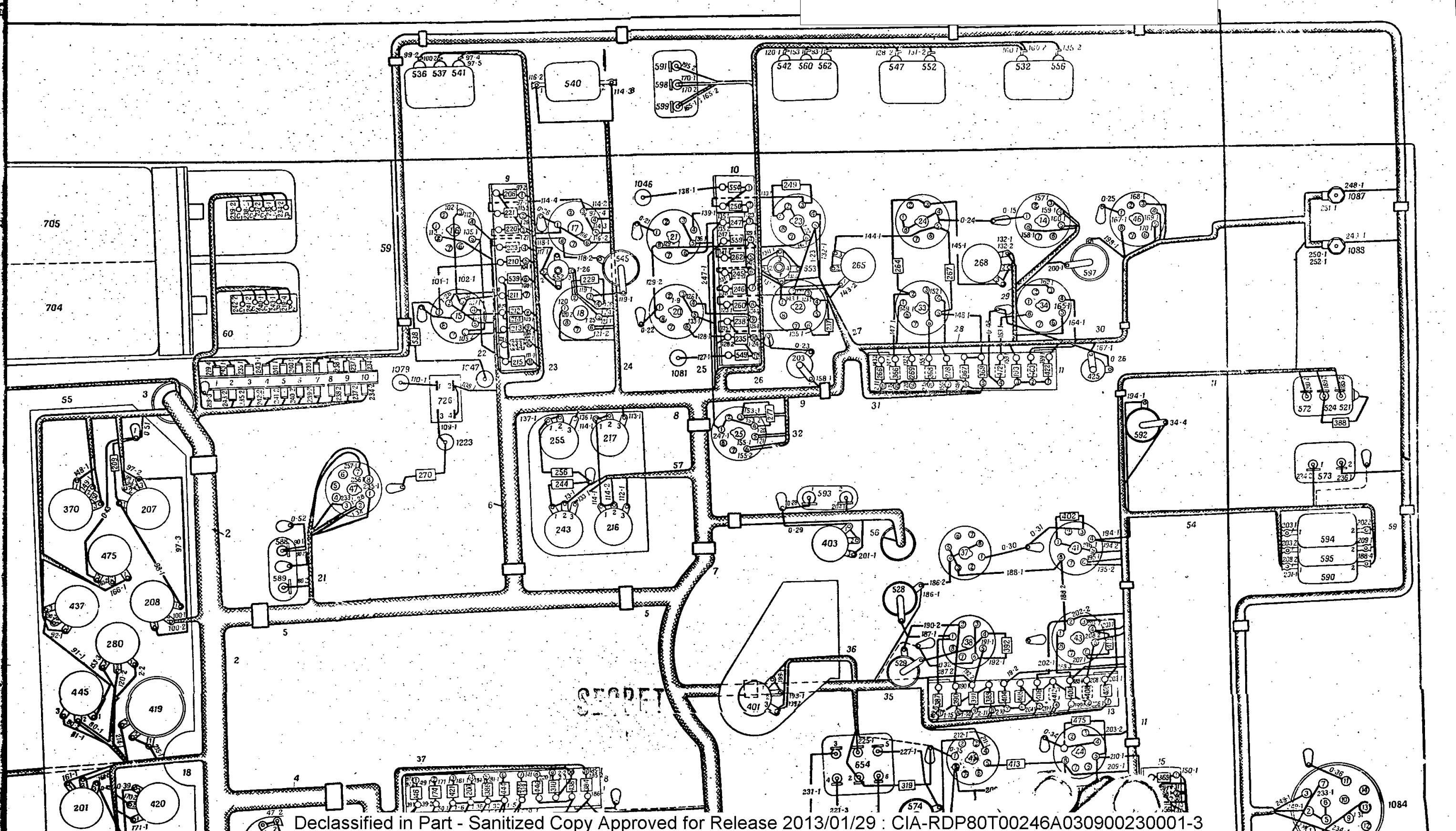
50X1-HUM



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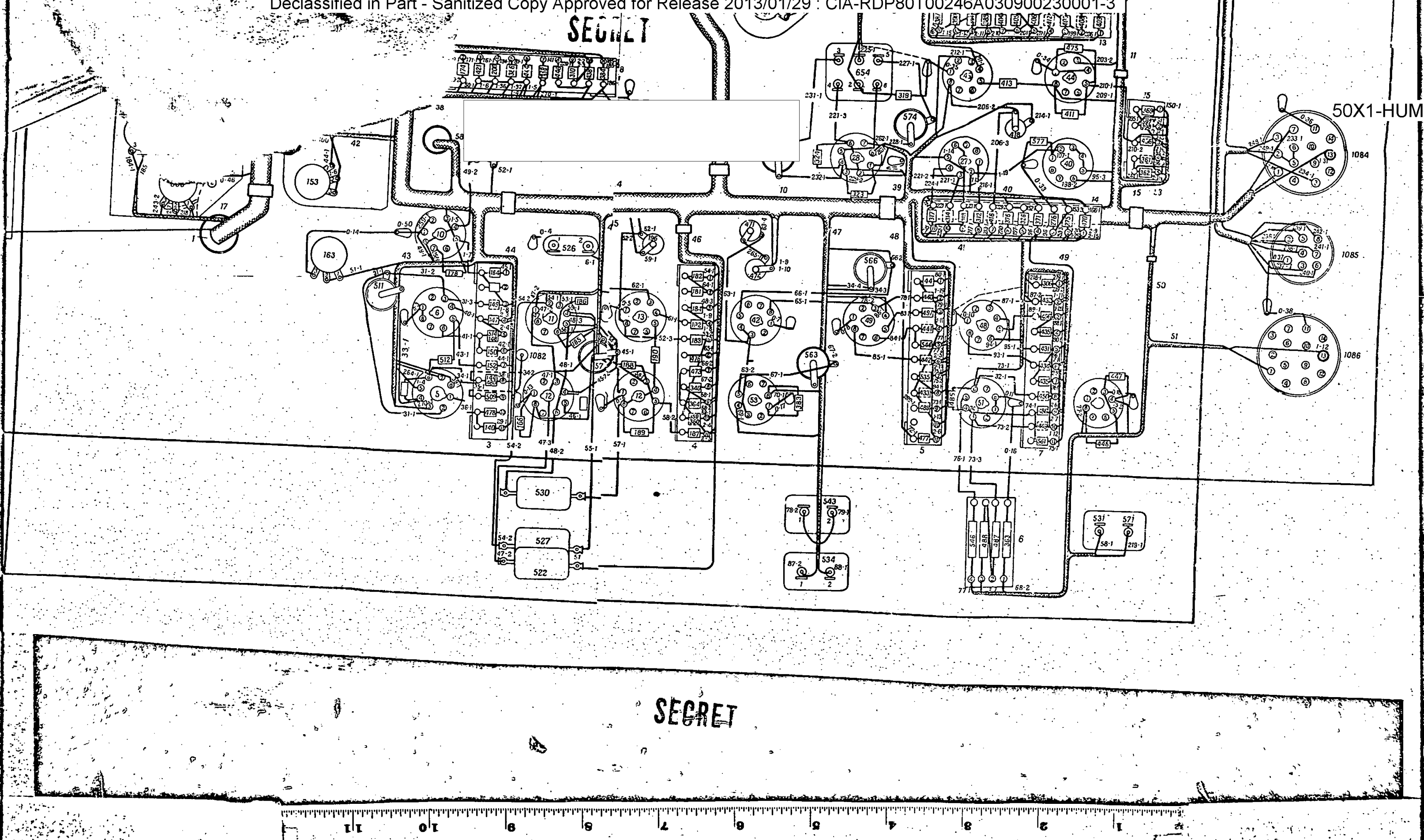

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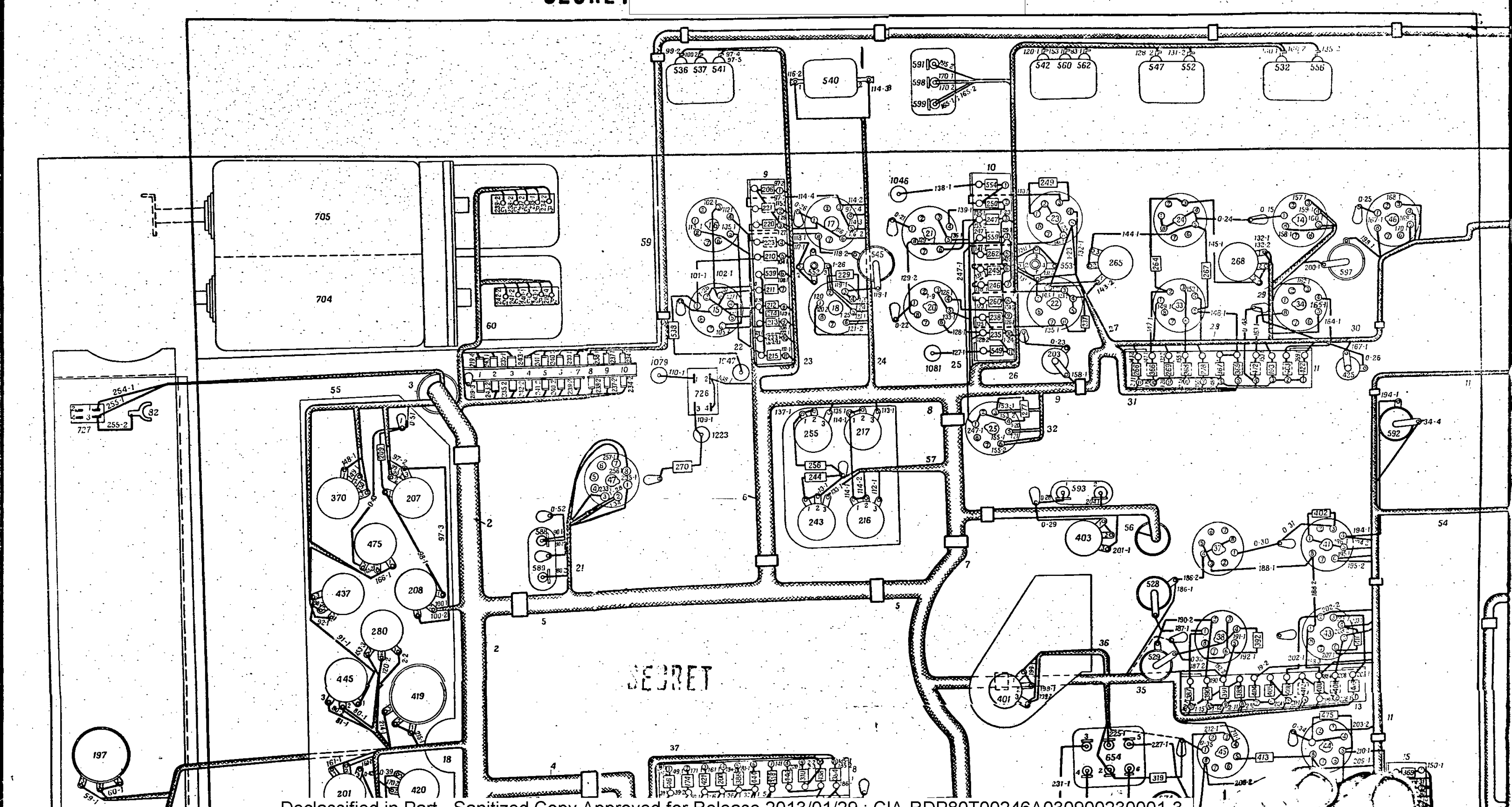


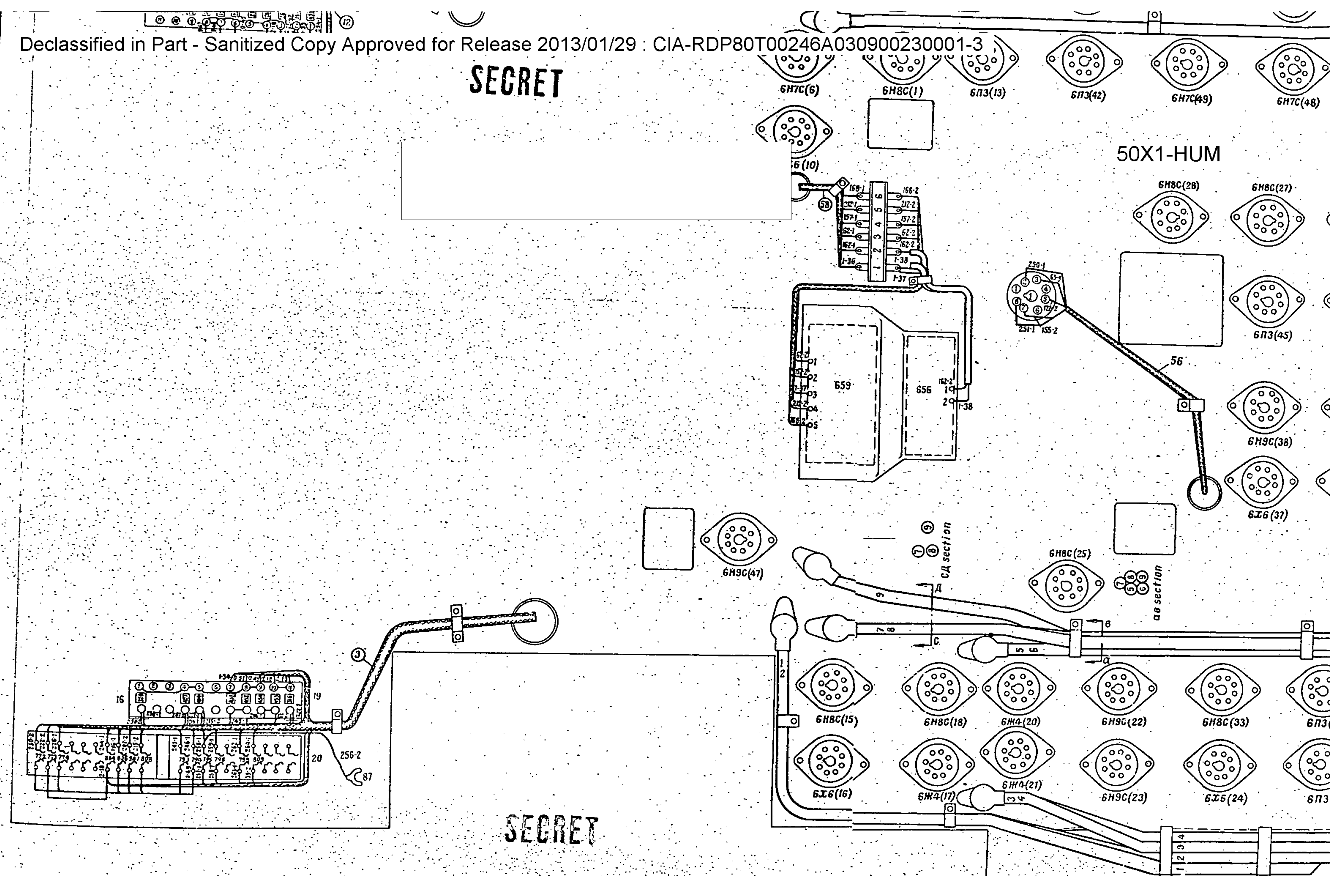


Fig. 22. Wiring Diagram of Height Indicator (Unit НО-02 Top View)

MAXIMUM FIELD FOR LATER USE WITH 3M

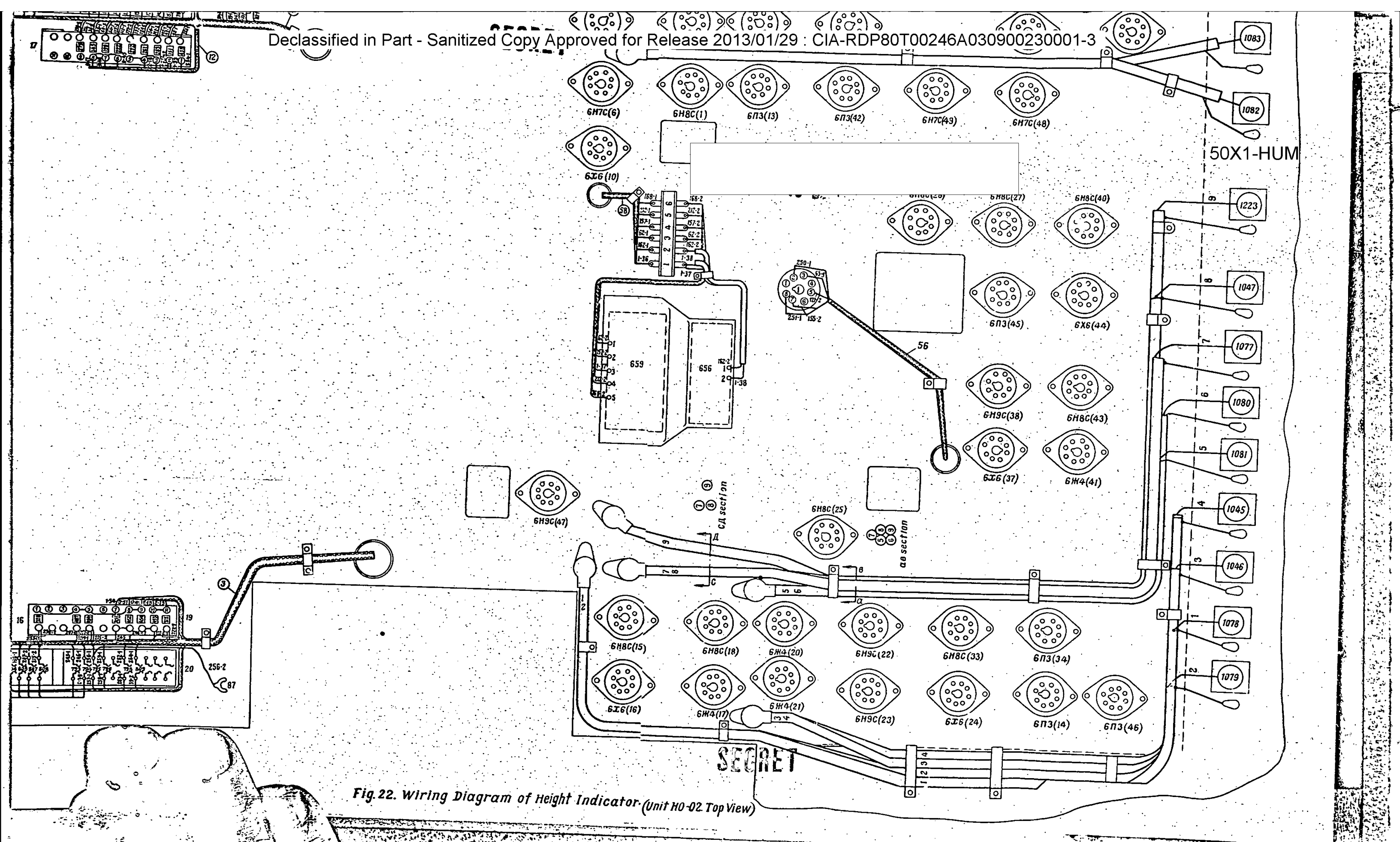
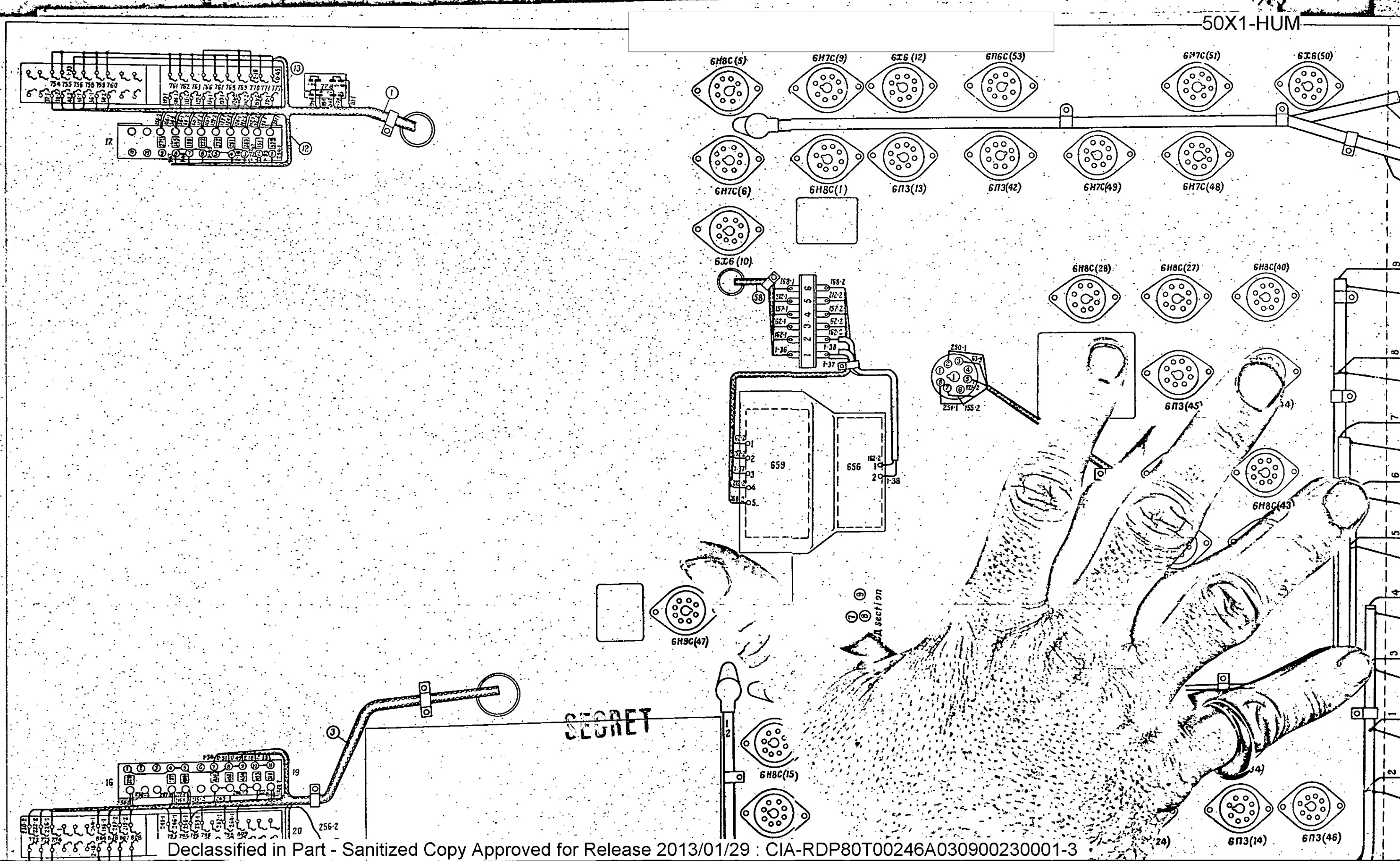


Fig. 22. Wiring Diagram of Height Indicator (Unit НО-02 Top View)

50X1-HUM


6H8C(5)
6H7C(9)
6Ж8(12)
6П6C(53)
6H7C(51)
6Ж8(50)
6H7C(6)
6H8C(1)
6П3(13)
6П3(42)
6H7C(49)
6H7C(48)
6Ж8(10)
6H8C(28)
6H8C(27)
6H8C(40)
6П3(45)
6H8C(43)
659
656
6H9C(47)
A section
6H8C(15)
6П3(14)
6П3(46)
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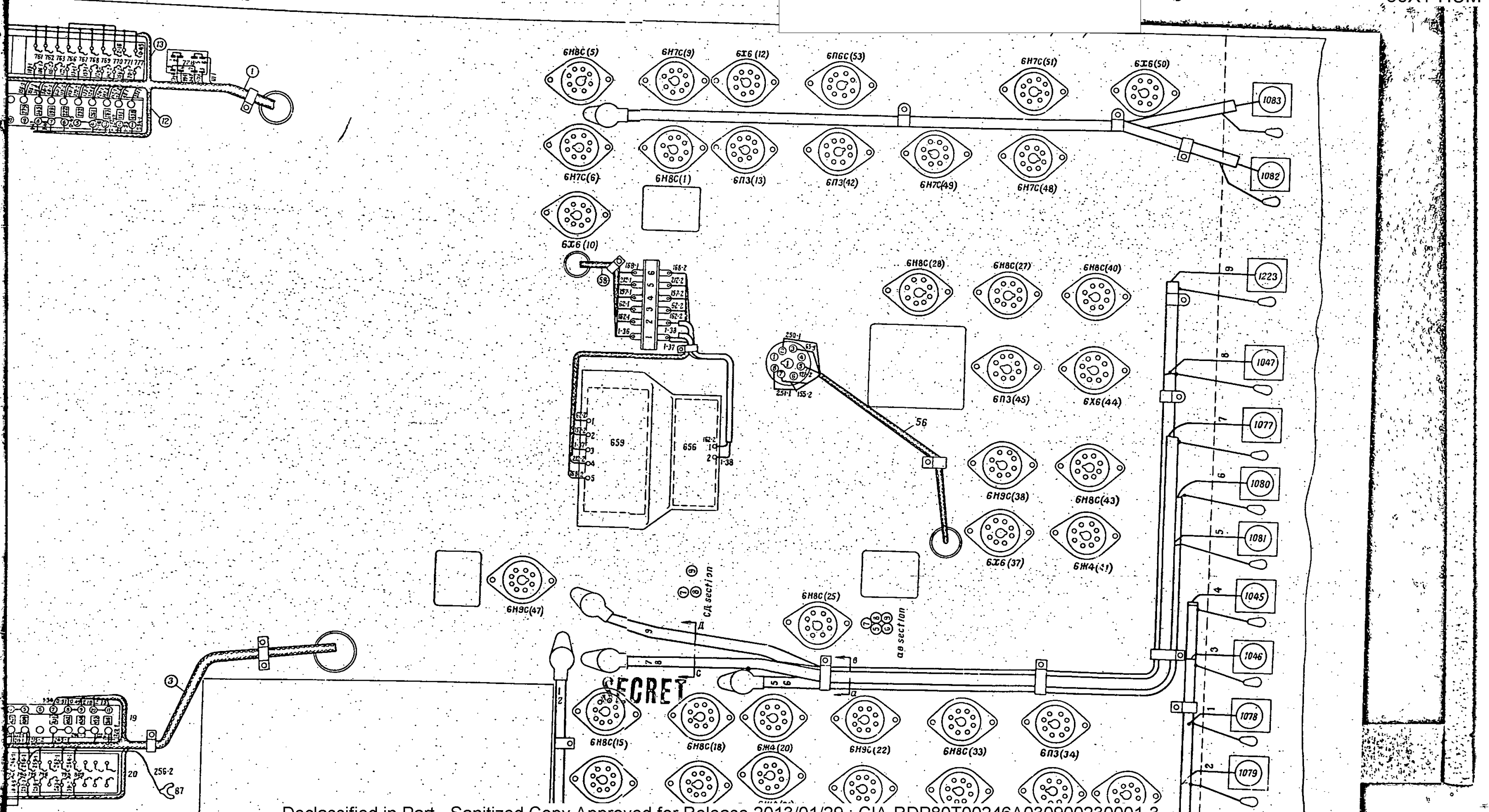

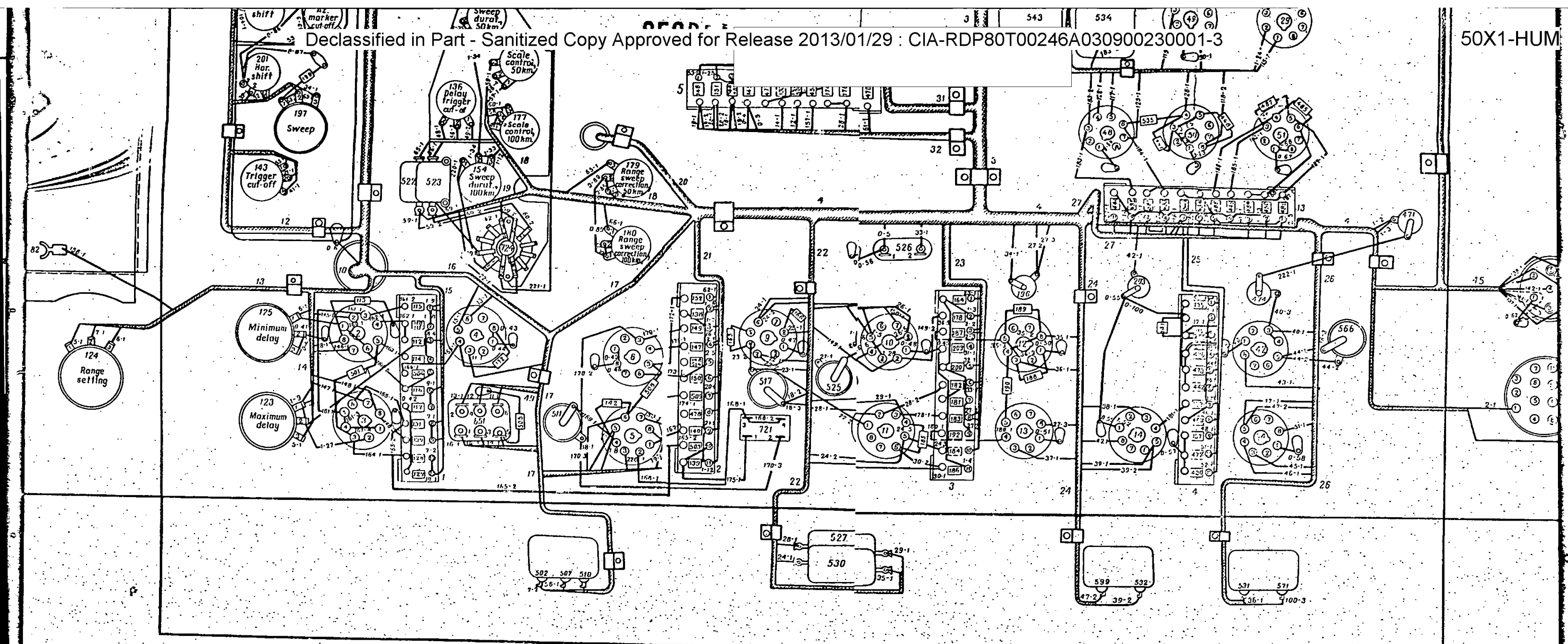

Fig. 23. Wiring Diagram of Azimuth-Range Indicator (Unit BO-01. Bottom View)

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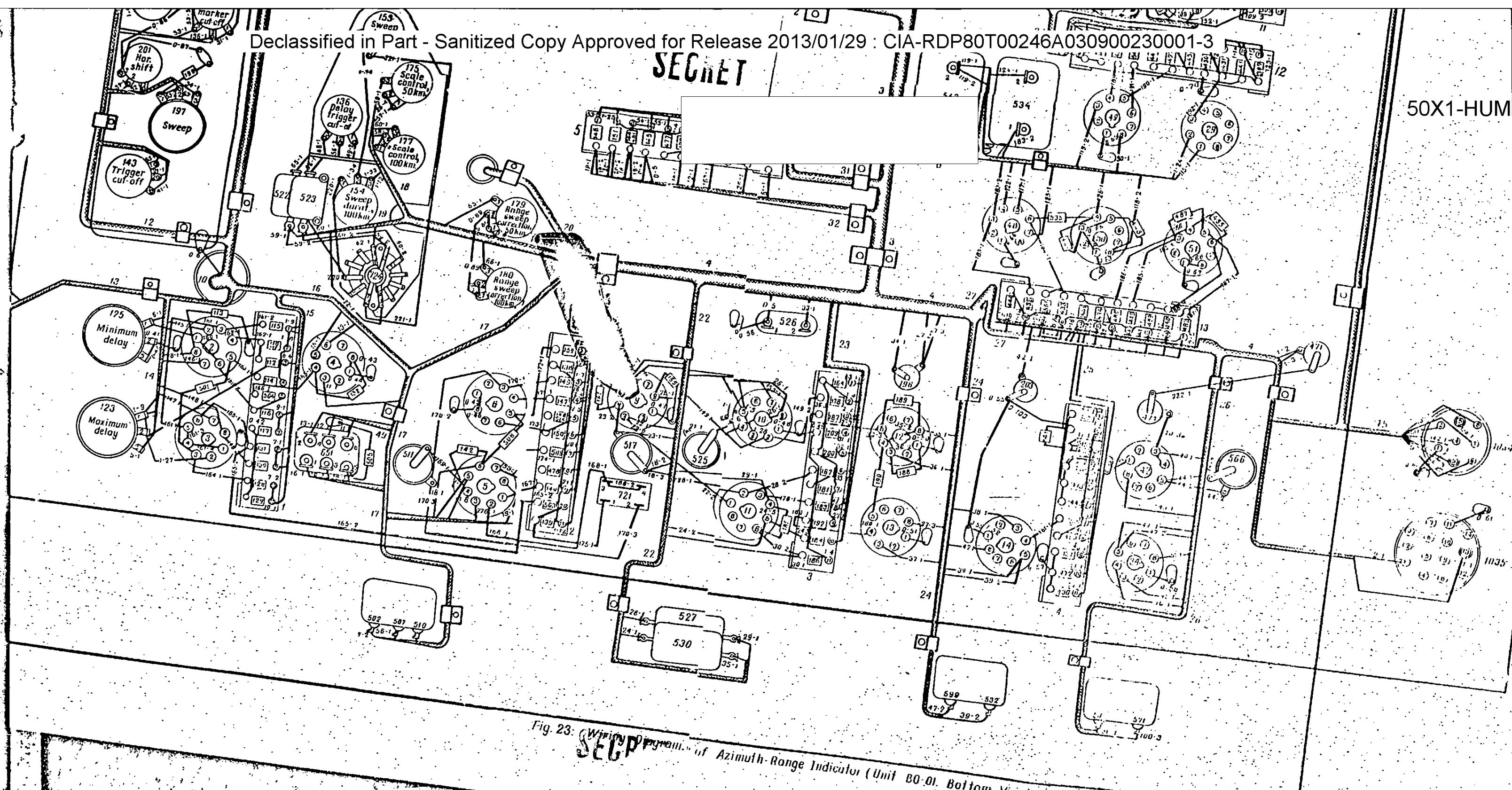
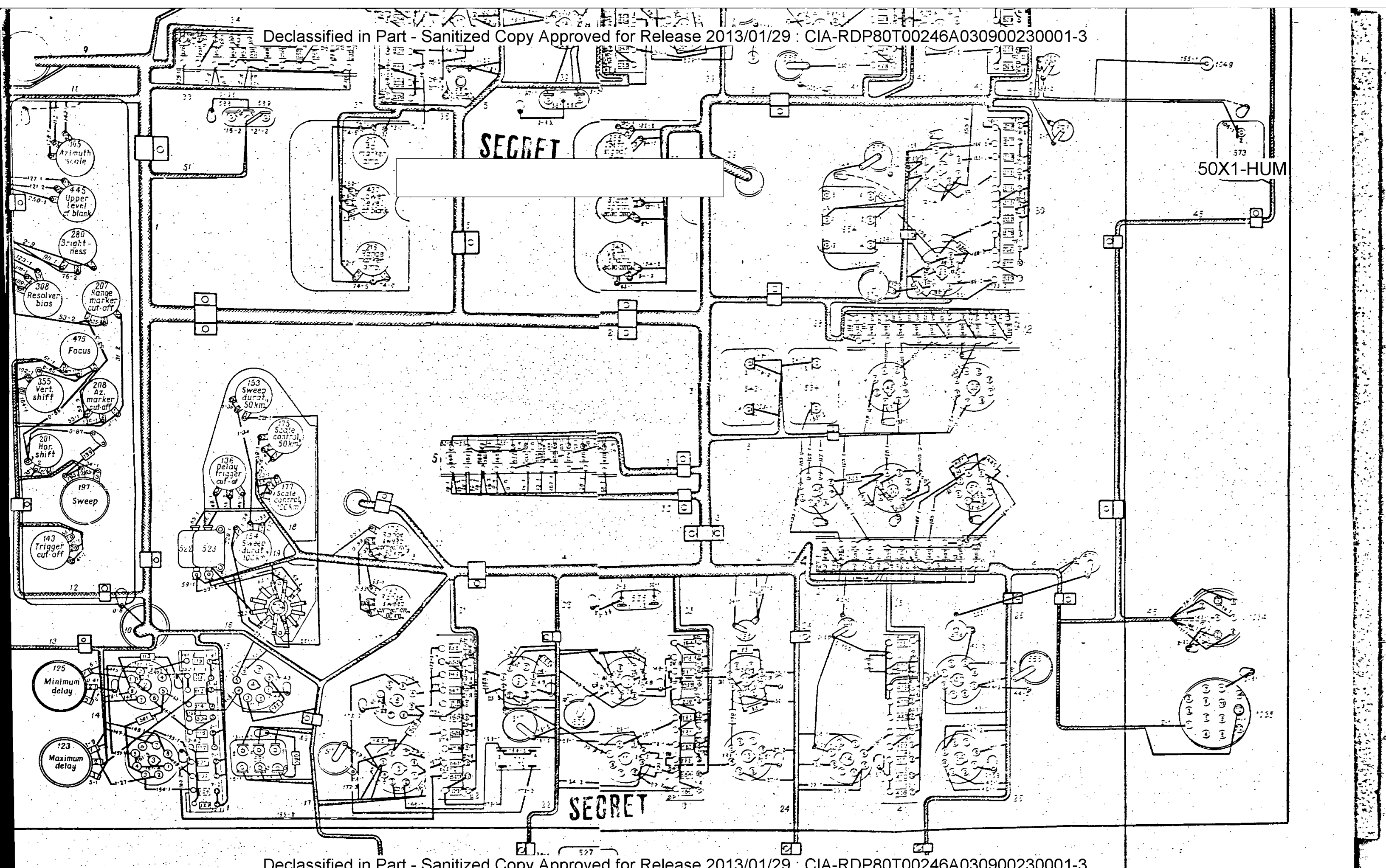


Fig. 23. Wiring Diagram of Azimuth-Range Indicator (Unit 80-01. Bottom View)



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445 Upper level of blank
280 Bright-ness
308 Resolver bias
207 Range marker cut-off
475 Focus
355 Vert. shift
208 Az. marker durat. cut-off
201 Hor. shift
197 Sweep
143 Trigger cut-off
153 Sweep durat. 50 km
175 Scale control 50 km
136 Delay trigger cut-off
177 Scale control 100 km
154 Sweep durat. 100 km
125 Minimum delay
123 Maximum delay
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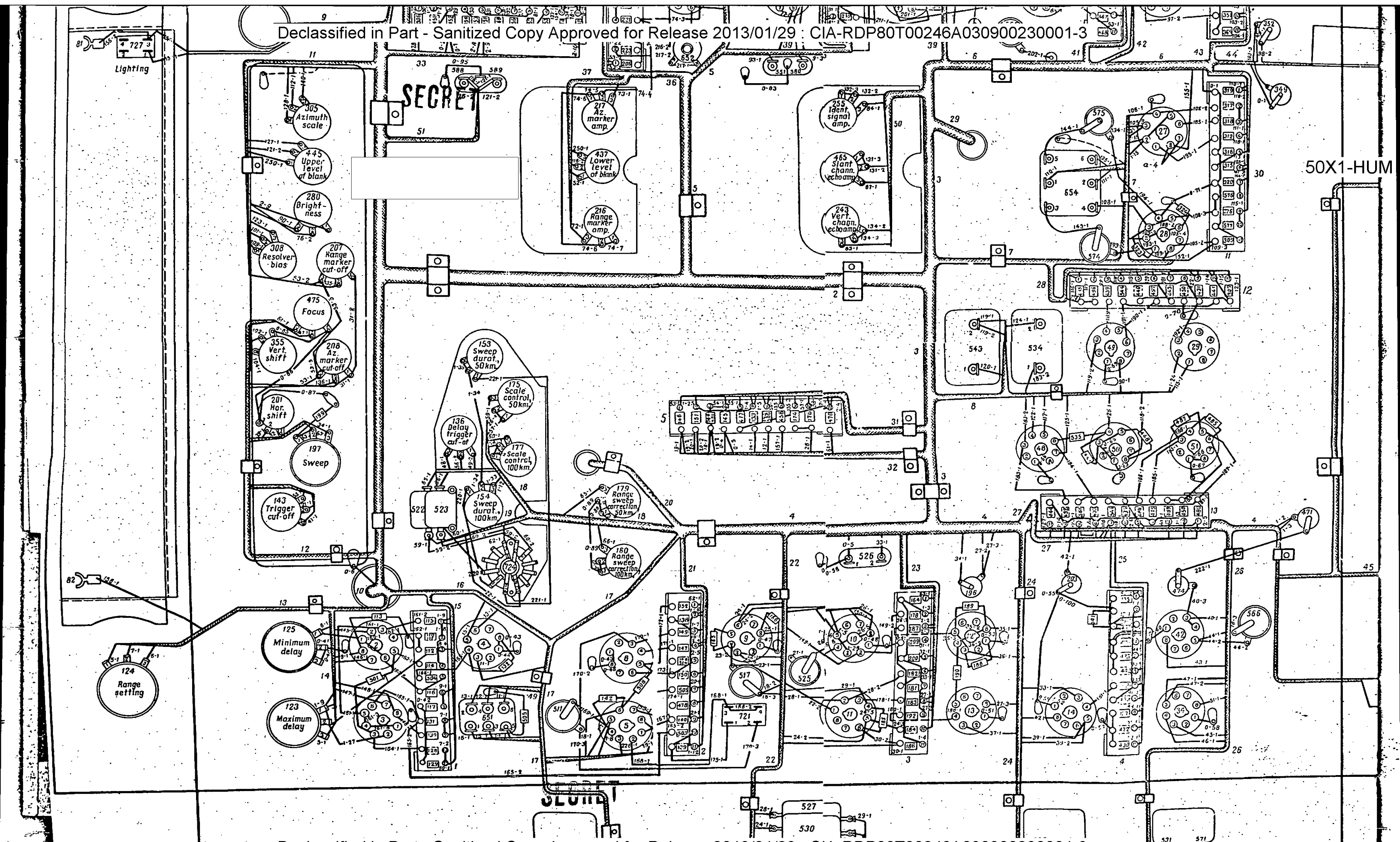
Lighting
305 Azimuth scale
445 Upper level of blank
280 Brightness
308 Resolver bias
207 Range marker cut-off
475 Focus
355 Vert. shift
208 Az. marker cut-off
201 Hor. shift
197 Sweep
143 Trigger cut-off
125 Minimum delay
123 Maximum delay
124 Range setting
217 Az. marker amp.
437 Lower level of blank
216 Range marker amp.
255 Ident. signal amp.
465 Slant chann. echo amp.
243 Vert. chann. echo amp.
153 Sweep durat. 50 km.
175 Scale control 50 km.
136 Delay trigger cut-of
177 Scale control 100 km.
154 Sweep durat. 100 km.
179 Range sweep correction 50 km.
180 Range sweep correction 100 km.

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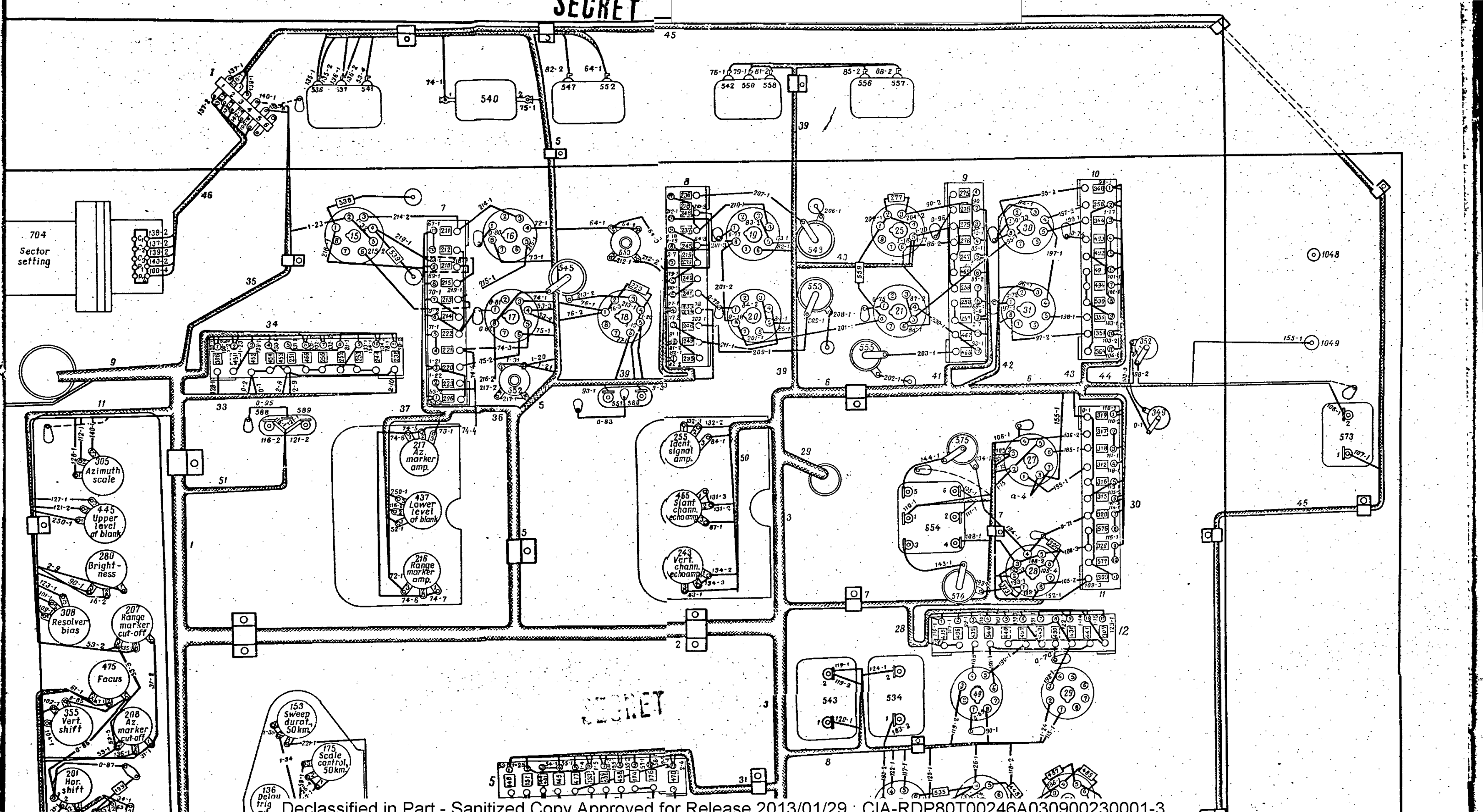
50X1-HUM



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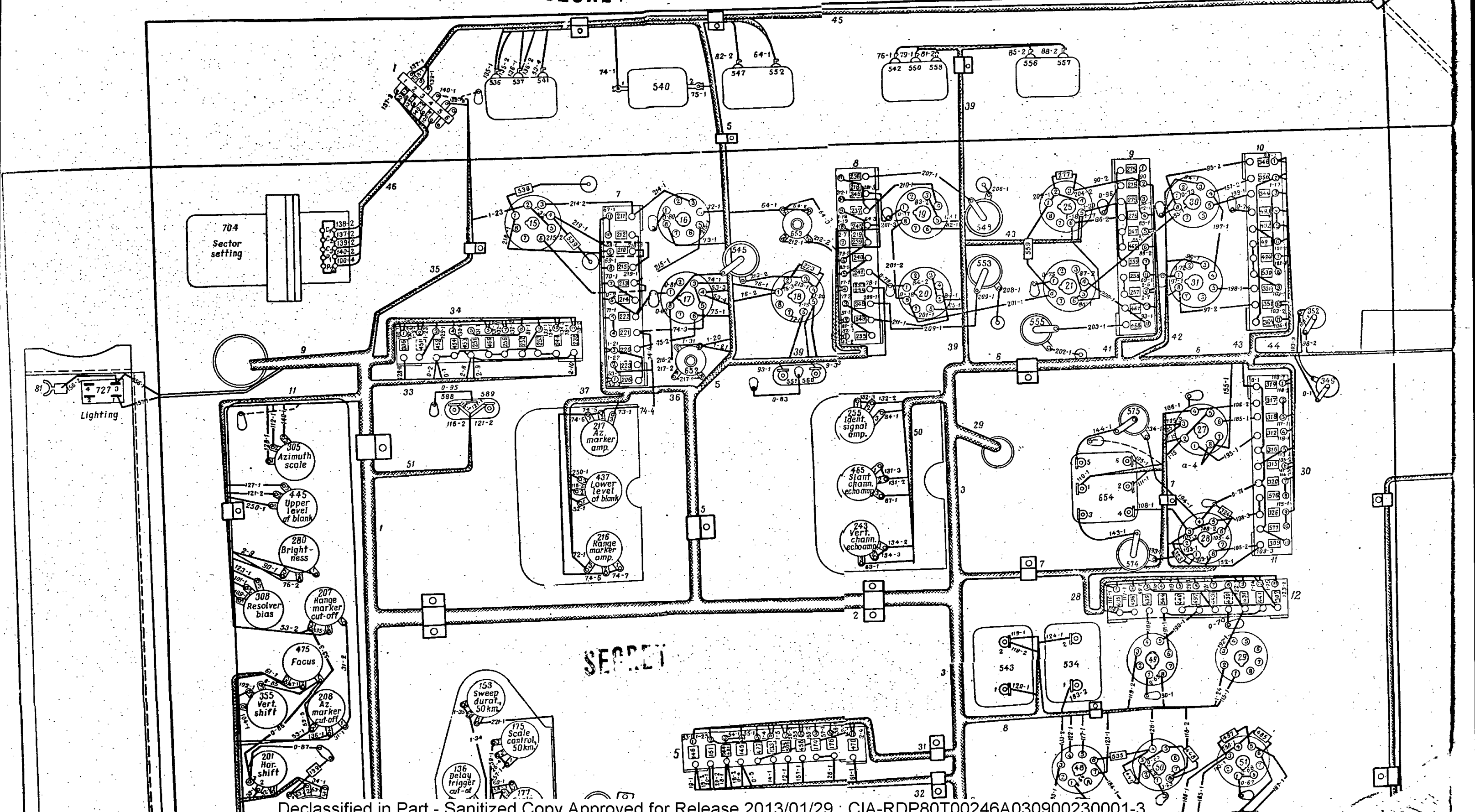

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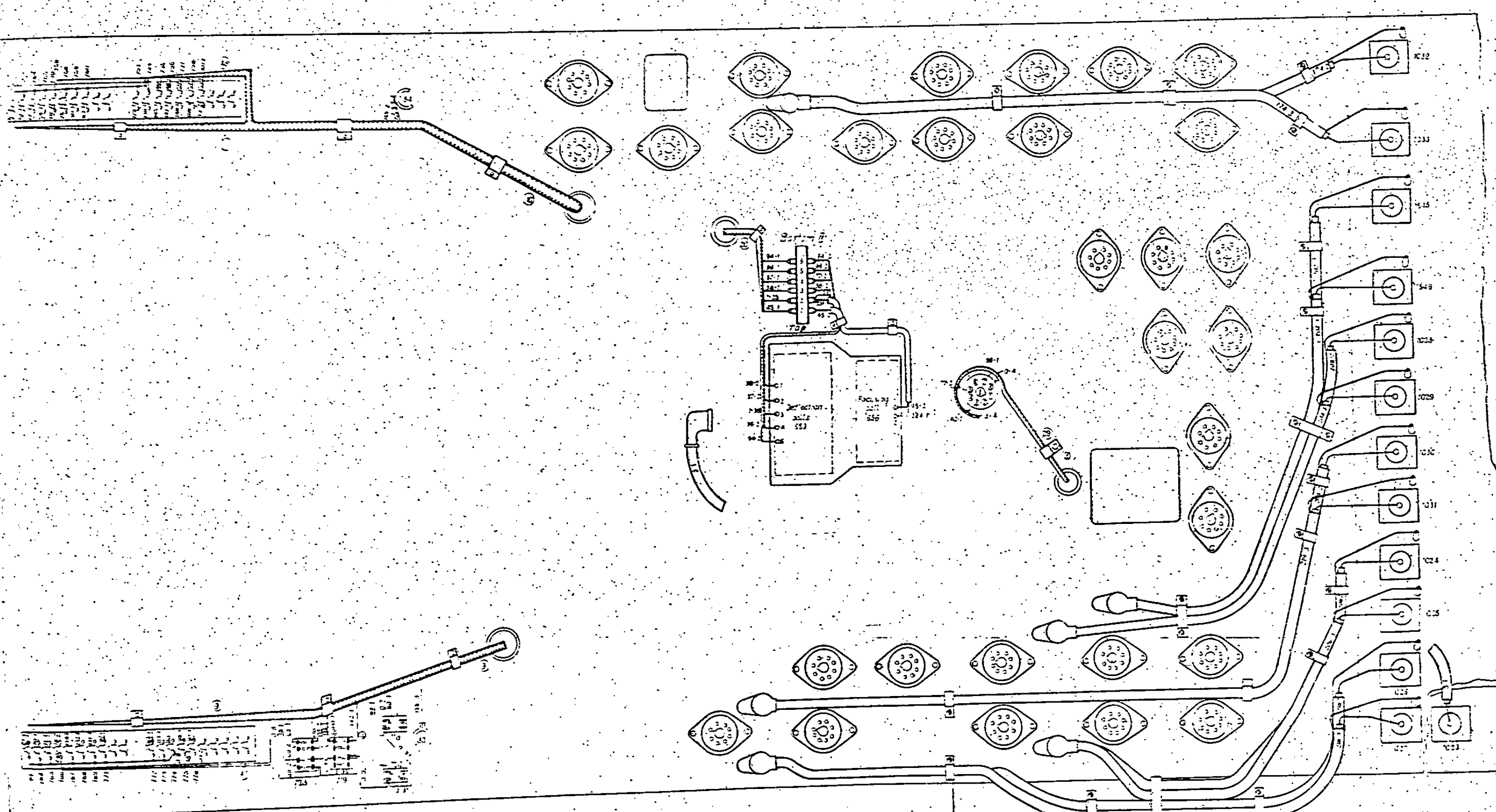

Fig. 24. Wiring Diagram of Azimuth-Range Indicator (Unit 30-CT, Top View)

Radar Station П-20
Operating Instructions

Page 206

Col 5
0
− 150
+ 300
+ 300
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Page 225

Col 5	6	7
0.7		−150
1.1		0
1.1		0
0.3		−150
0.3		−150
0.8		0
—	0.2	0
0.1		0
0.3		0
2.0	2.2	0

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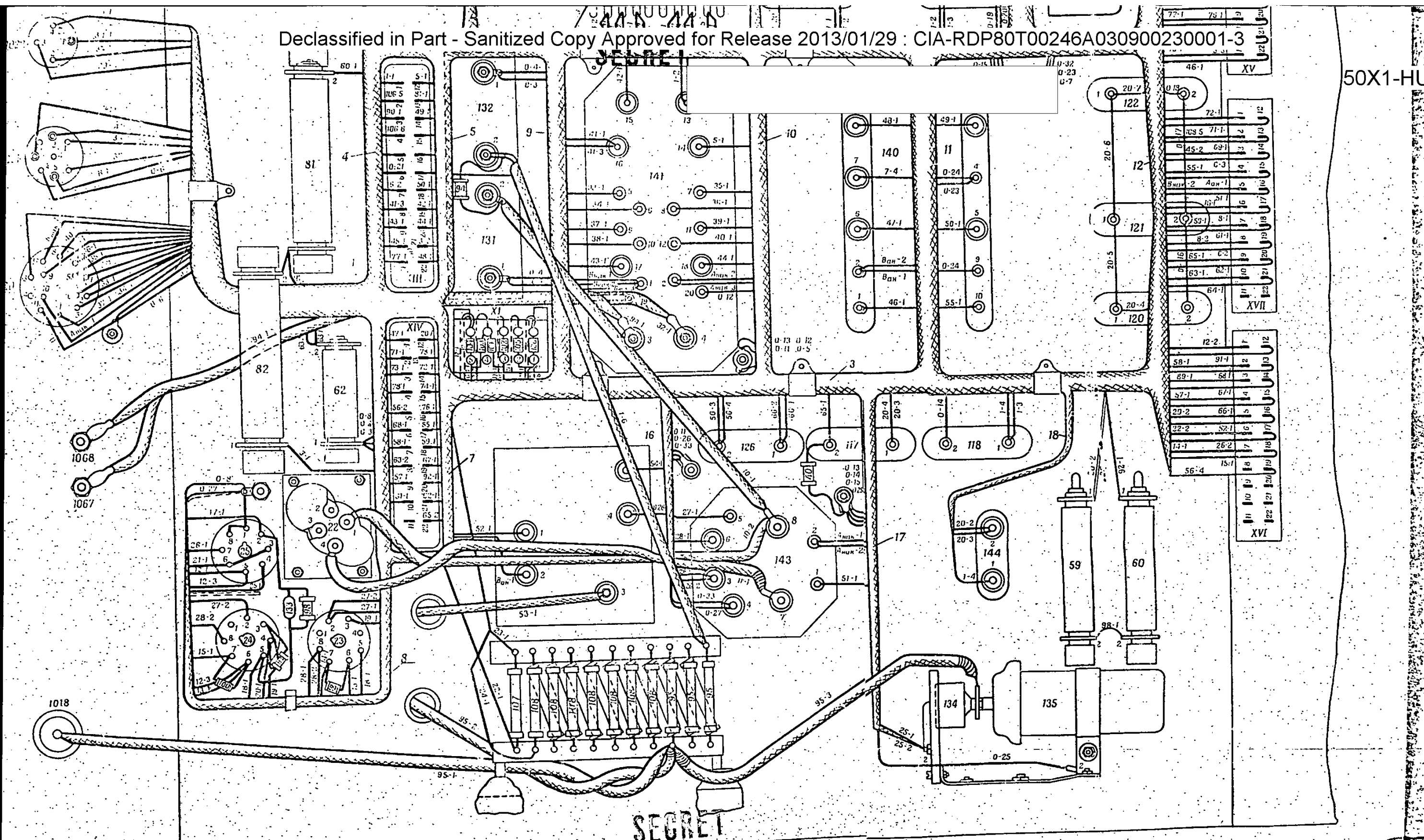

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Fig. 25. Wiring Diagram No. 1 of Supply Unit БП-01

MAXIMUM FIELD FOR LATER USE WITH 3M

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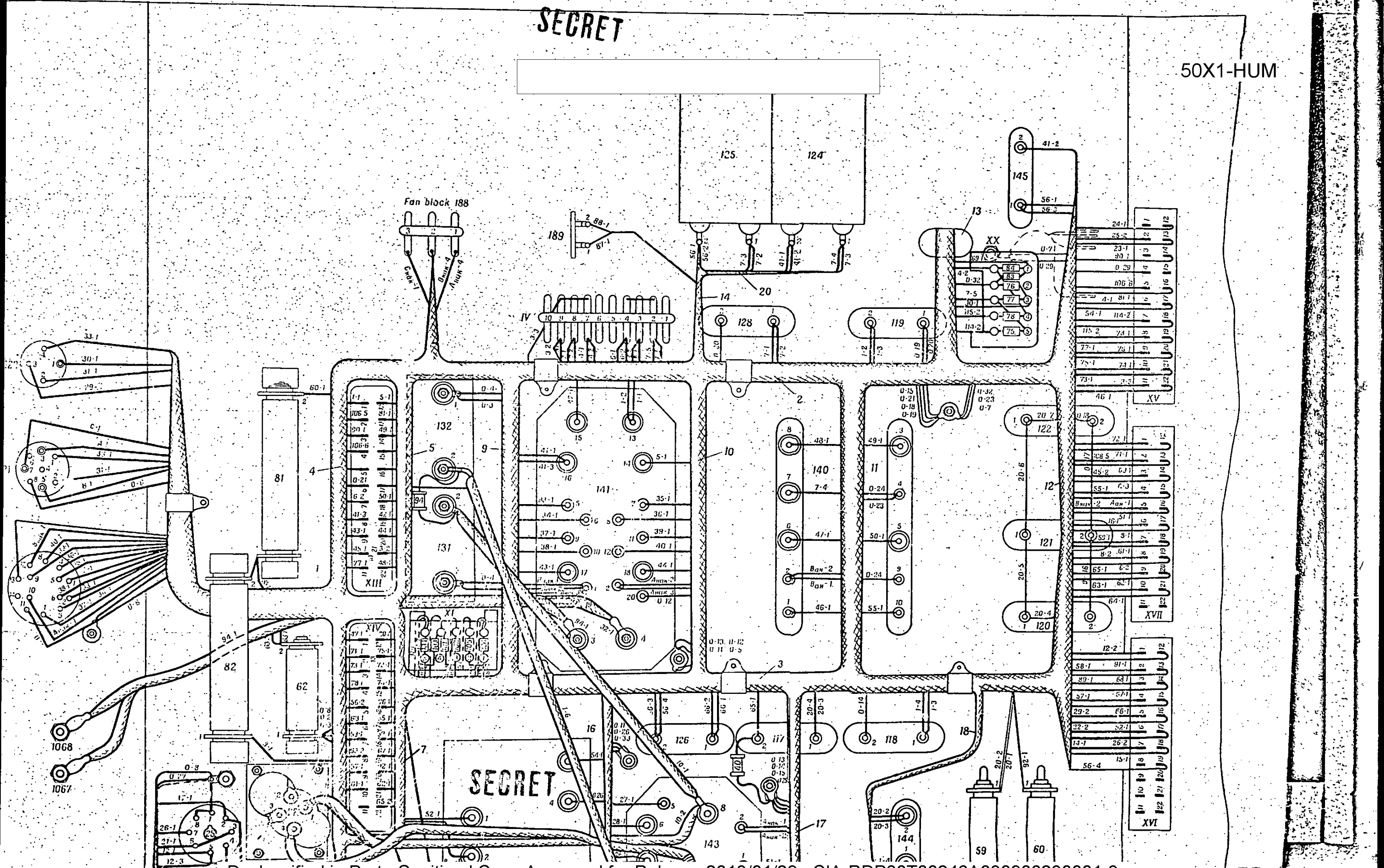

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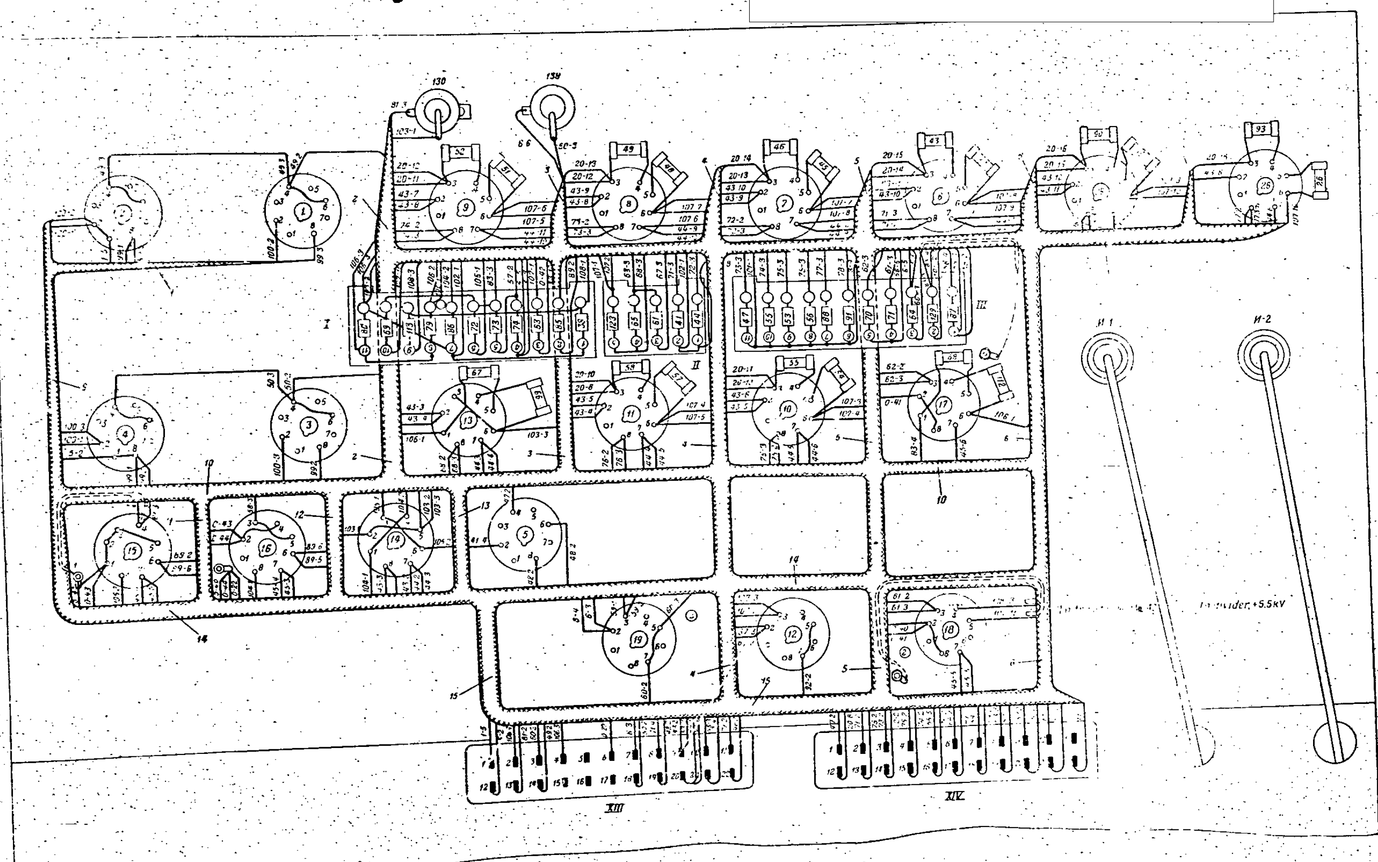

Fig. 26. Wiring Diagram № 2 of Supply Unit БП-01

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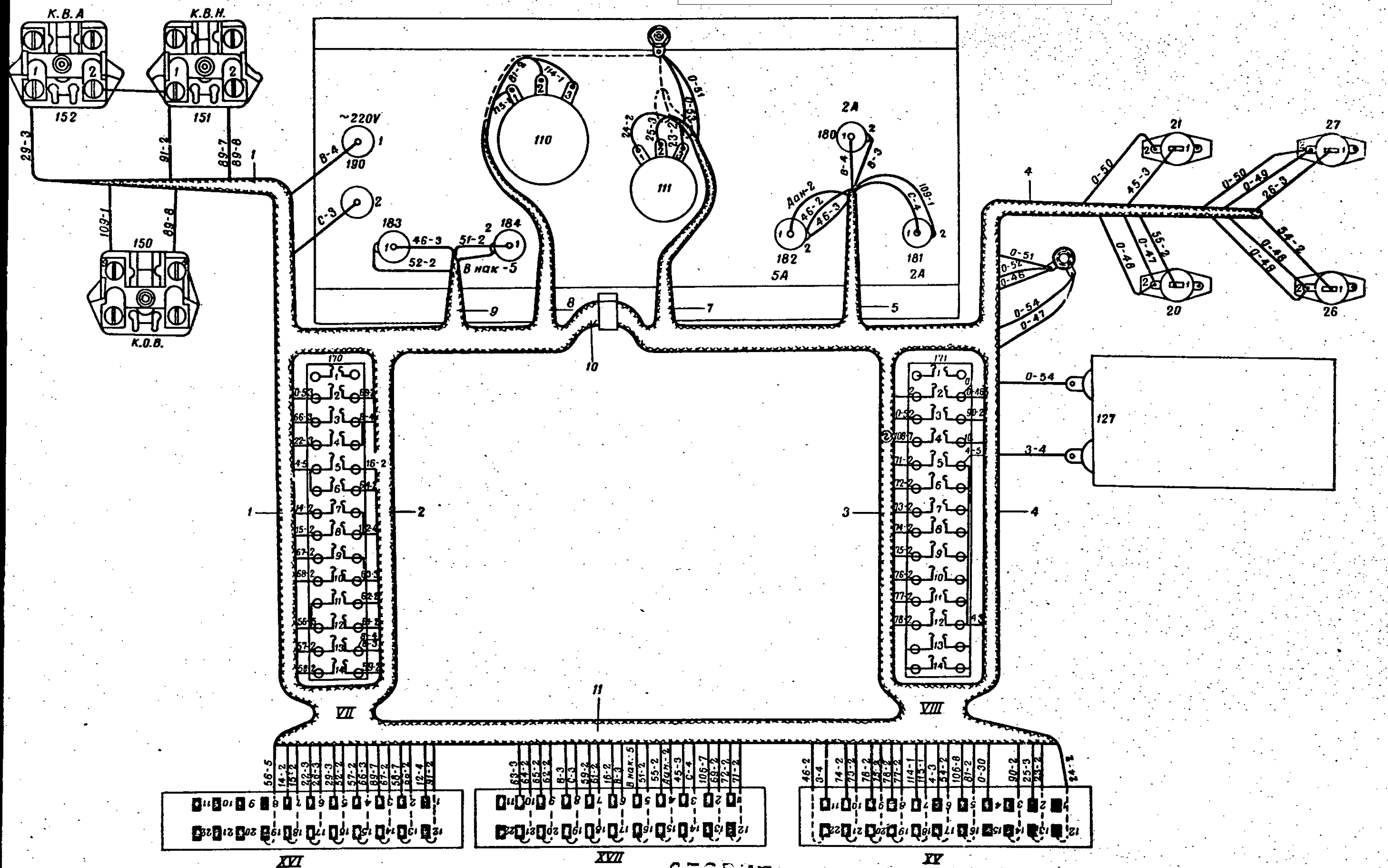

Fig. 27. Wiring Diagram No.3 of Supply Unit БП-01

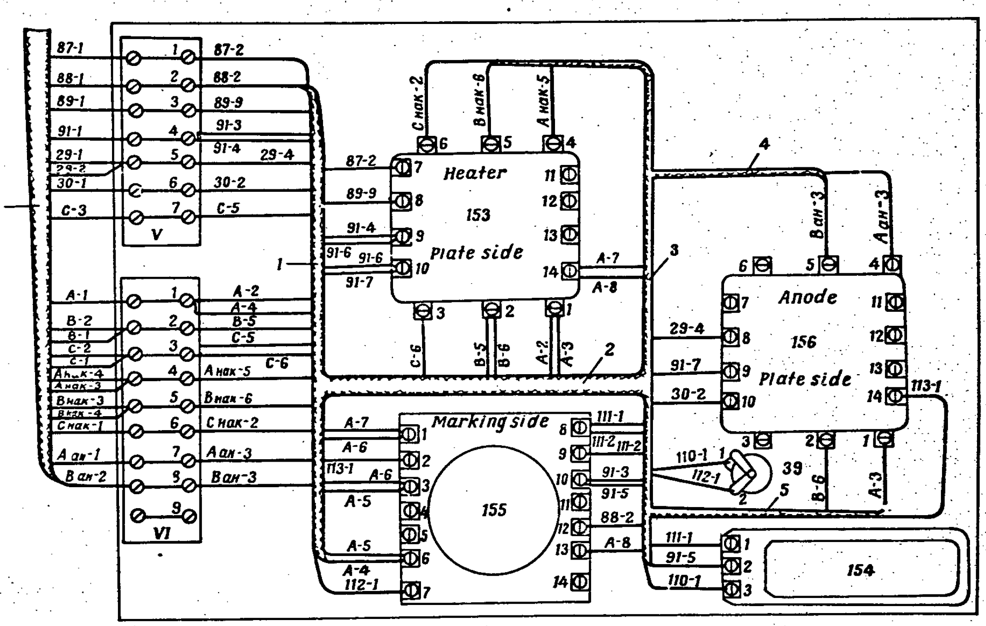

Fig. 28. Wiring Diagram No.4 of Supply Unit БП-01

[redacted] 50X1-HUM

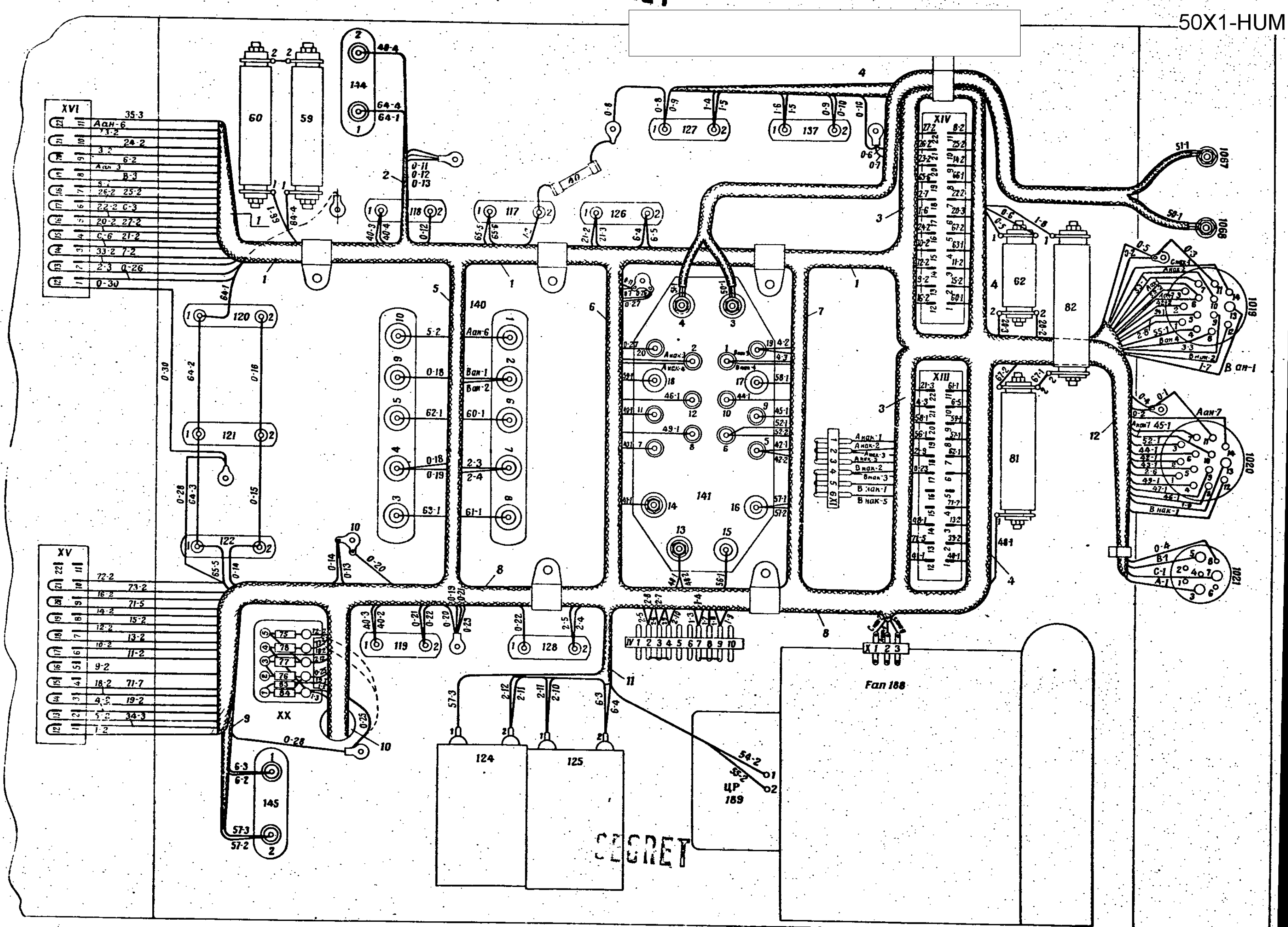

Fig. 29. Wiring Diagram No. 1 of Supply Unit БП-02

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50X1-HUM

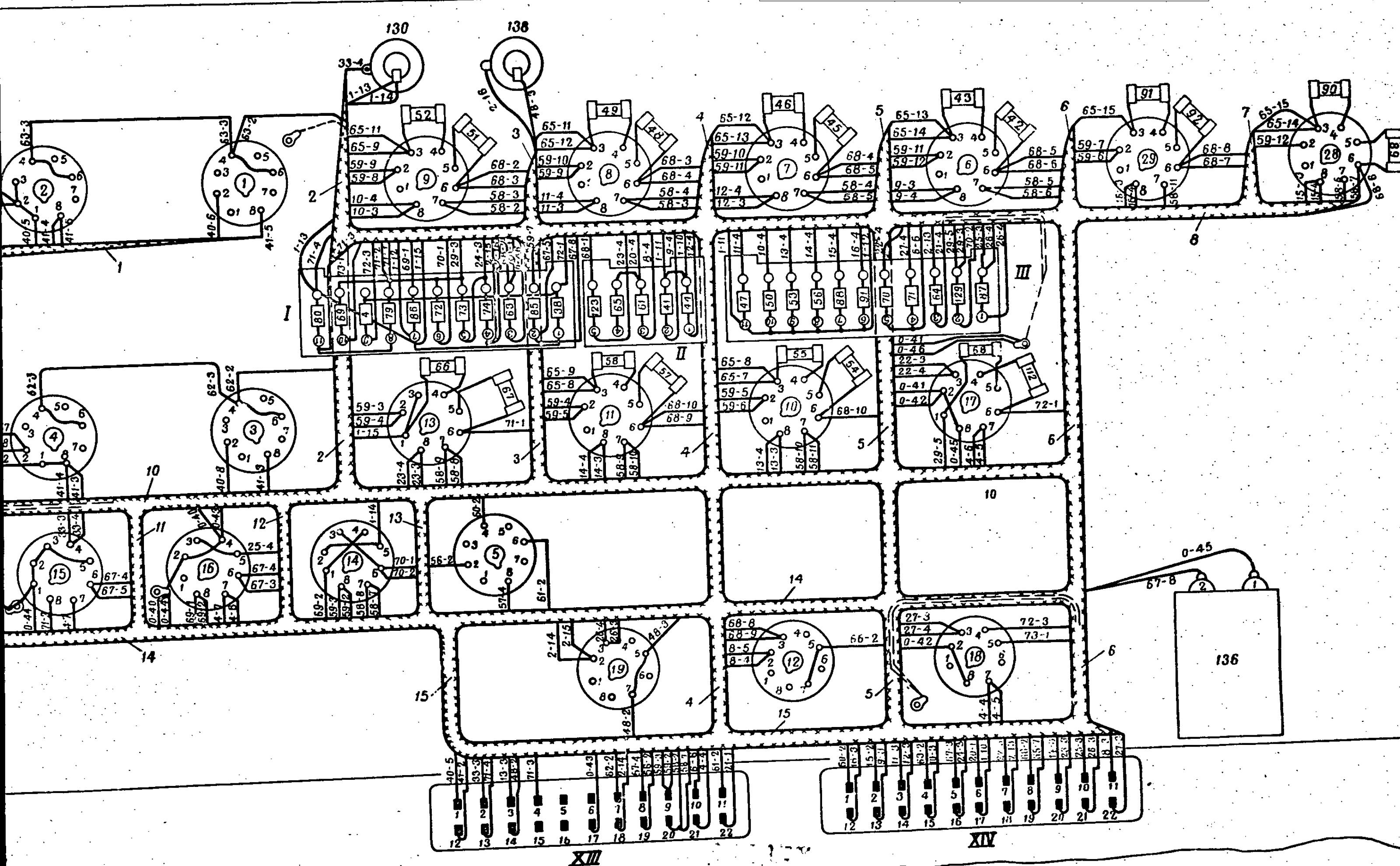

Fig. 30. Wiring Diagram No. 2 of Supply Unit БП-02

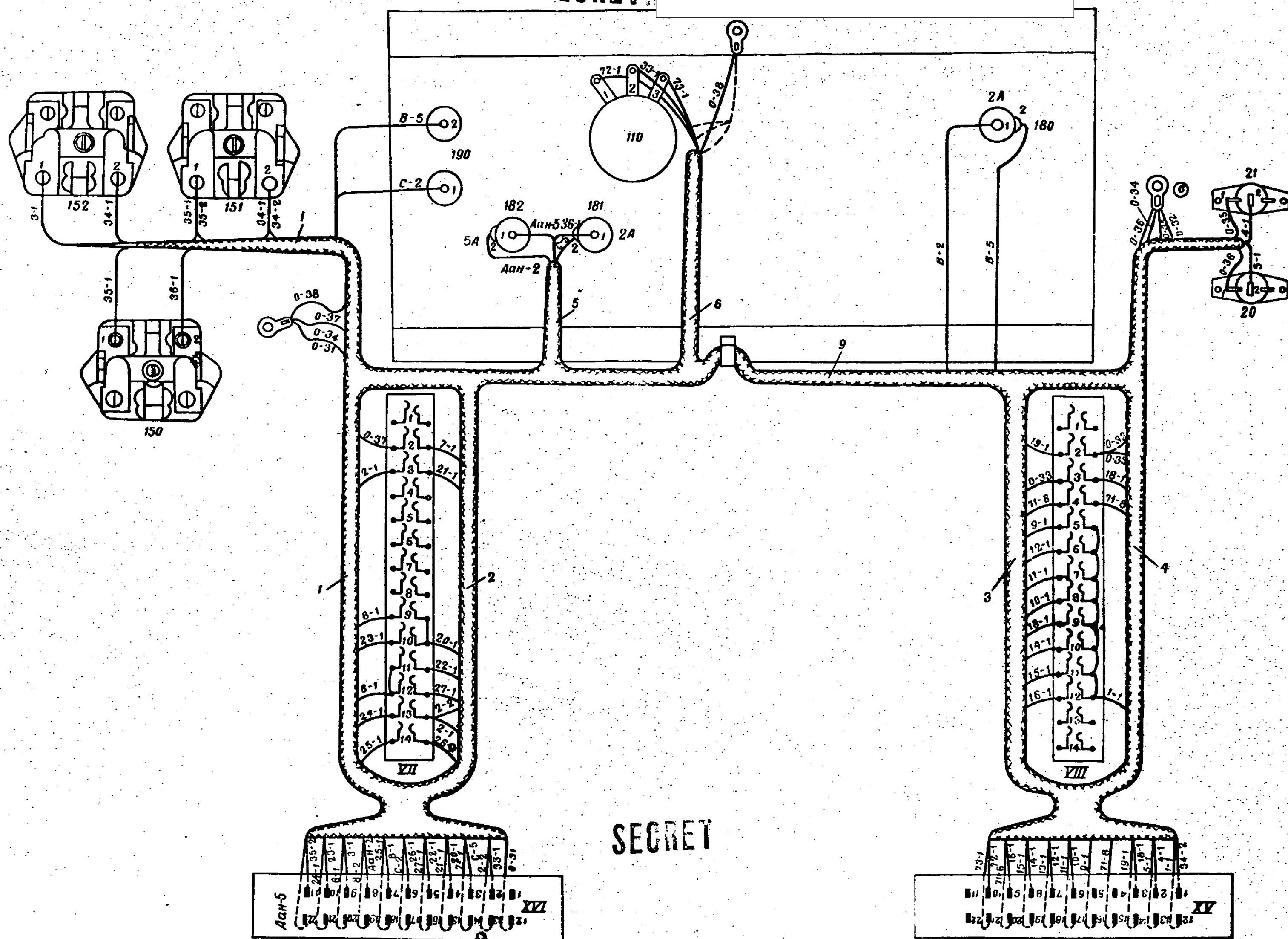

Fig.31. Wiring Diagram No.3 of Supply Unit БП-02

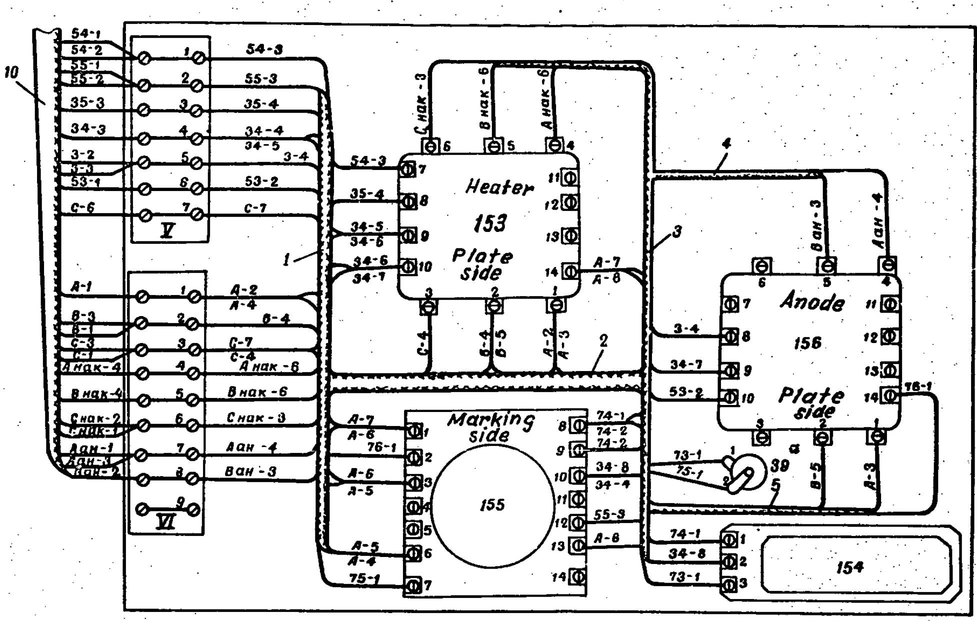

Fig. 32. Wiring Diagram No.4 of Supply Unit БП-02

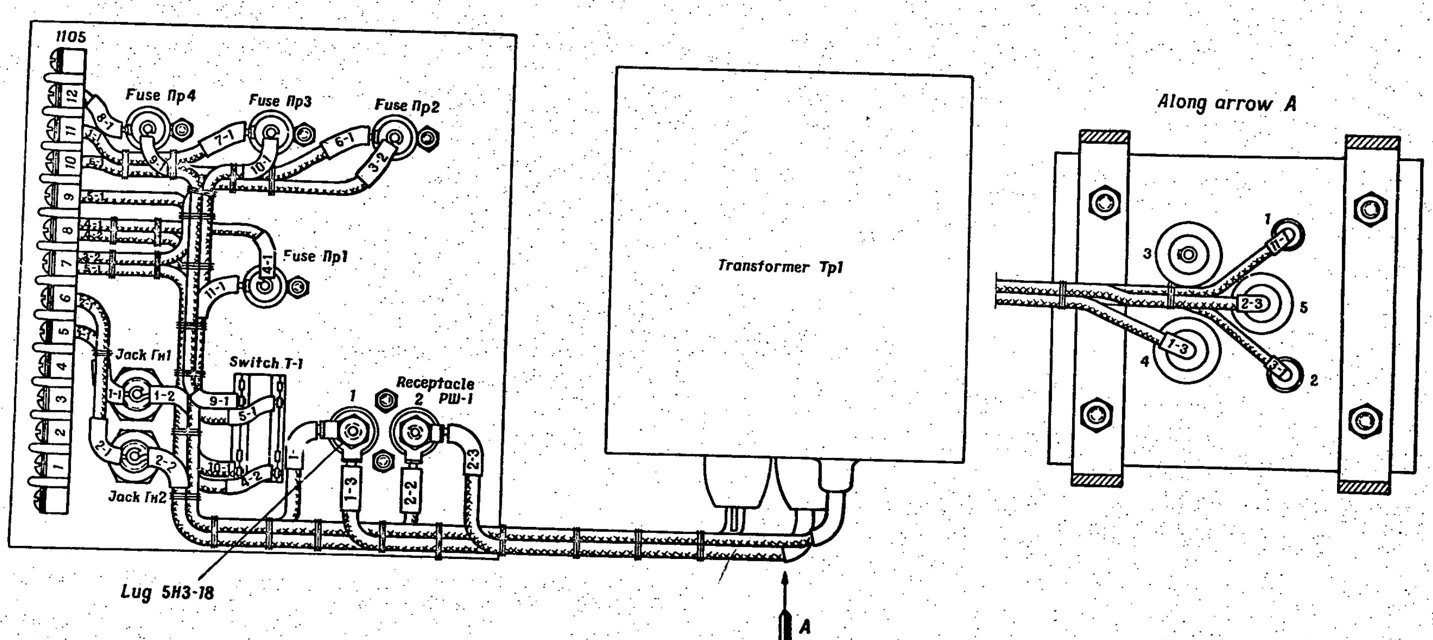

Fig. 33. Wiring Diagram of Control Panel (Unit ПУ-03)

Copy No. [redacted]

DESCRIPTION

OF ALTERATIONS MADE IN RADAR STATION TYPE П-20 (SUPPLEMENT)

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DESCRIPTION

OF ALTERATIONS MADE IN RADAR STATION TYPE П-20 (SUPPLEMENT)

The book contains 12 sheets, and 8 insets on 8 sheets.

Inset No. 1, Figs 22a, 22b, 23, 24 is between Page 6 and Page 7.

Inset No. 2, Fig. No. 29 is between Page 6 and Page 7.

Inset No. 3, Figs 28 and 99 is between Page 8 and Page 9.

Inset No. 4, Figs 100 and 101 is between Page 10 and Page 11.

Inset No. 5 is between Page 18 and Page 19.

Insets Nos 6, 7 and 8 are at the end of the book.

INTRODUCTIO

This book deals with the alterations made in the
type П-20, after publishing the Technical Manual. Fo
amplifier employing a travelling-wave valve caused cha
and ША-02 (now having new indices ШУ-50 and ША-50
with the signal channel mixer, and the modifications i

The Technical Manual and key diagrams cover the i
station, type П-20, after publishing the technical p

Those changes which could not be given in the Tec
plement.

INTRODUCTION

This book deals with the alterations made in the circuit diagram and design of the station, type П-20 , after publishing the Technical Manual. For example, the incorporation of the H.F. amplifier employing a travelling-wave valve caused changes in the construction of cabinets ШУ-02 and ША-02 (now having new indices ШУ-50 and ША-50), replacement of the antenna switch with the signal channel mixer, and the modifications in the control.

The Technical Manual and key diagrams cover the improvements made in the design of the radar station, type П-20, after publishing the technical papers.

Those changes which could not be given in the Technical Manual are dealt with in this supplement.

ANTENNA SWITCH

In transmission the antenna switch provides for channelling the H.F. power from the magnetron to the antenna and protects the receiver from high voltages; in reception it ensures channelling the H.F. power from the antenna to the receiver with insignificant losses.

The switch is made as a section of the rectangular waveguide, which carries two gas-filled dischargers, directional coupler and AFC channel mixer.

The general view of the switch is given in Fig.22a, and its block diagram in Fig.22b.

The lower discharger, type PP-7 (Fig.23), is placed in the resonator connected with the waveguide through the slot in the narrow wall. The resonator with the discharger is called antitransmit-receive tube (ATR-tube).

The rectangular discharger is installed in the wide wall of the rectangular waveguide (Fig.23) at a distance of 1/2 λ from the ATR-tube λ the wavelength in the waveguide).

When the channel is assembled, the discharger is secured between the antenna switch and the flange of the waveguide junction. The branch consisting of a half-wave section and rectangular discharger is called transmit-receive switch (TR switch). The rectangular discharger serves as a preliminary protection discharger.

Discharger PP-7 is an argon-filled glass envelope. The two brass diaphragms of the envelope mount hollow cone-shaped spindles, so that the gap between their ends is adjusted by a screw located on the end face of the discharger. Being placed in the chamber, it serves as a toroidal resonator, the resonance frequency of which is adjusted by changing the gap between the cone-shaped spindles.

The preliminary protection discharger is a quarter-wave section of the waveguide.

The ends of the section are closed with diaphragms - thin metal sheets with rectangular openings.

The rectangular glass envelope is filled with argon and water vapours and is placed inside the waveguide section. The dimensions of the diaphragms are so chosen that they resonate to the frequency of the transmitter.

Due to this the electric field strength near the diaphragm is higher than that in the adjacent waveguide, and the discharger is fired more easily. Since the resonance characteristics of the diaphragm vary widely, its dimensions are so selected that they correspond to different waves. Accordingly, four types of the dischargers are used: type PP-20 for АПЕ, type PP-2 for АПД and АПГ, type PP-3 for АП-В, type PP-4 for АП-А.

Equivalent Circuit of the Antenna Switch

Low power in the waveguide results in low voltage across the spark gap of the discharger, type PP-7; in this case the discharger is not punctured and its cavity circuit is equivalent to the tuned circuit with relatively large Q-factor.

When the energy is delivered through the waveguide from the magnetron, the voltage across the spark gap of the discharger is increased, the spark gap is punctured, and the cavity circuit

of the discharger becomes equivalent to the greatly detuned circuit. Since the Q-factor of the circuit is great, the equivalent resistors of the circuit differ, depending on whether the spark gap is punctured or not.

So, the dischargers may be used for switching over the antenna for reception and transmission.

The equivalent circuit of the antenna switch (Fig.24) employs a two-wire line. A branch from the narrow wall of the waveguide is shown as a section of line, connected in parallel with the main line. A branch from the wide wall of the waveguide is shown as a section of line connected into the gap in the main line.

Such replacement is admissible only when one mode of oscillation is employed in the waveguide. The waveguide under consideration features the H_{01} mode only.

Inserted in parallel with the line is the discharger of the ATR tube shown as equivalent circuit 1.

Inserted into the gap of the line is the discharger of the transmit-receive switch (2) shown as two spark gaps placed at a distance of 1/4 λ from each other.

Circuit Operation during Reception

The discharger of the ATR tube is connected with the waveguide through a narrow wall slot. The arrangement of the discharger corresponds to connection of the equivalent resonant circuit into the two-wire line through the quarter-wave branch.

In points "aa" the output resistance is very great since the resonant circuit is not loaded (the discharger is not punctured).

This resistance is converted into the infinitely low resistance through the quarter-wave branch. Therefore, when not punctured, the discharger of the ATR tube short-circuits the equivalent two-wire line. Since the discharger of the ATR tube is placed at a distance of 1/2 λ from the discharger of the transmit-receive switch, H.F. energy is not branched off from the antenna to the magnetron (the input resistance of the half-wave line, closed at the end, is equal to zero).

The discharger of the transmit-receive switch is connected with the waveguide through the slot in the wide wall.

They are so coupled that the input resistance of the discharger of the transmit-receive switch is coordinated with the waveguide, and the energy of the echo signals is delivered to the reception channel without great losses.

Circuit Operation during Transmission

During transmission the spark gaps of the ATR tube and TR switch dischargers are punctured. The circuit of the discharger of the ATR tube is detuned, and its input resistance becomes infinitely low and through the quarter-wave stub is converted into infinitely high resistance connected in parallel with the main line. So the H.F. energy freely passes from the magnetron to the antenna without being reflected from the discharger of the ATR tube.

If the high voltage is available in the main channel, the gas inside discharger 2 is ionized and the electrodeless puncture is caused in the second opening of the discharger.

AFC Channel Mixer

The AFC channel mixer (Fig.29) serves for converting the H.F. pulses fed to its input from the transmitter via the attenuator into the I.F. pulses.

The AFC mixer is a coaxial circuit which employs the detector, type ДГС . This circuit is connected with the rectangular waveguide of the antenna switch by means of coupling loop 1

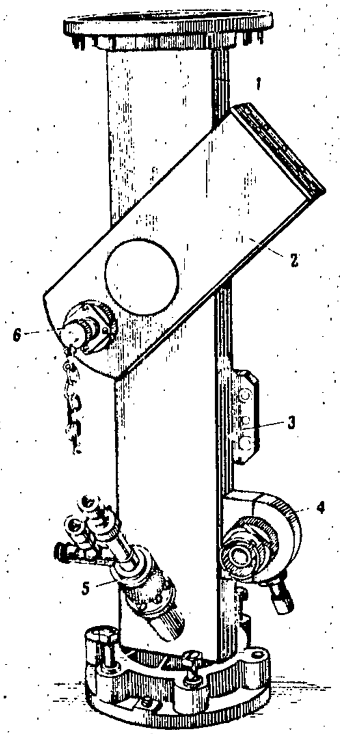


Fig 22a General View of Antenna Switch
1-rectangular waveguide, 2-directional coupler 3-flange for connecting rectangular discharger, 4-ATR-cell with round discharger; 5-AFC mixer, 6-test connector for measurements

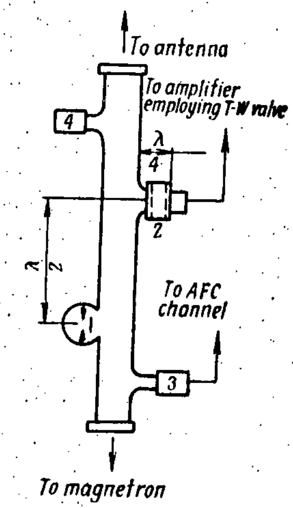


Fig.22b. Block Diagram of Antenna Switch

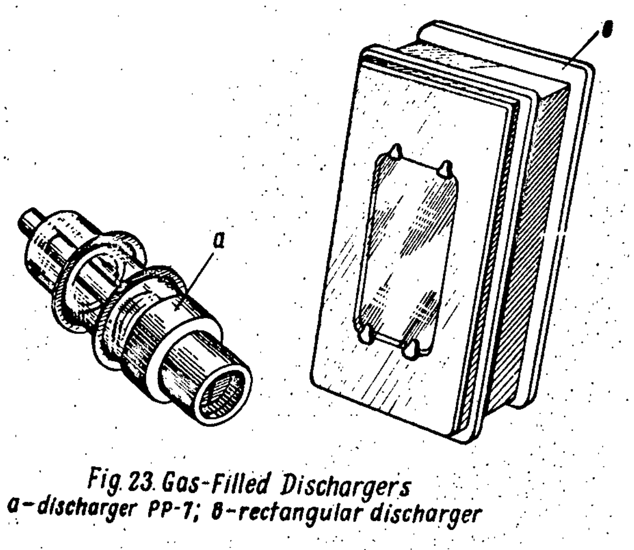


Fig. 23. Gas-Filled Dischargers
a-discharger PP-7; б-rectangular discharger

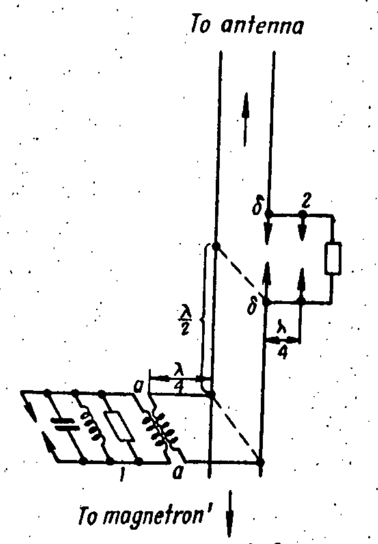


Fig.24. Equivalent Circuit of Antenna Switch
1-equivalent circuit of ATR-tube; 2-TR-switch

via attenuator 4. The attenuator (cylindrical tube 2) is soldered to the wide wall of the main waveguide of the antenna switch.

To choose the optimum value of attenuation at combined tuning, the APC mixer with the coupling loop may be shifted axially, the signal attenuation value being increased or decreased. The necessary attenuation value is fixed by means of collet 3. For shorter waves corresponding to the highest harmonics of the magnetron (3rd, 5th) the attenuation value is lower, and the power of these harmonics getting on the crystal would burn or damage it. To prevent this, the attenuator incorporates two additional plates 4 made of a material with great losses (pertinax with an absorbing layer). The signal voltage, after passing through the attenuator, is taken by the coupling loop and is used for exciting the oscillations in the mixer circuit. The voltage from the heterodyne is fed to the mixer coupler through connector 6.

The voltage, fed from the heterodyne to the APC mixer, is controlled by means of a special device. Inner spindle 7 of the heterodyne input of the mixer is connected via T-joint 9 with movable rod 10 terminating in end piece 11. The end piece of the rod, being placed at a small distance from inner conductor 5 of the mixer, serves for establishing the capacitive coupling. The gap between the end piece and inner conductor 5 is adjusted by means of nut 12 rigidly connected with rod 10. The rod is fixed by a lock nut.

The plug connector of the mixer heterodyne input contains gasket 8 with an absorbing layer. This gasket balances the mixer input with the characteristic impedance of the cable delivering the voltage from the heterodyne to the mixer. The intermediate frequency is taken from the detector by means of a special plug connector. The connector is fitted with quarter-wave filter 13 protecting the input of the APC circuit from high frequencies.

Directional Coupler

The directional coupler serves as a coupling element in measuring the wavelength and spectrum of the magnetron, the power in the channel and the sensitivity of the receiver.

The directional coupler is a short length of the waveguide connected through the wide wall slot with the main waveguide. It is installed under some angle to the waveguide wide wall; from one side it is provided with an absorber, and from the other - with a balanced output to the standard 50-ohm connector. The absorber serves for creating the travelling wave condition inside the directional coupler.

In the antenna switch, type АП-I, the directional coupler is installed perpendicular to the wide wall of the waveguide.

The directional coupler responds differently to the waves propagating in the waveguide in opposite directions, due to which the instrument cut in at its output measures the power of the incident wave only (i.e. moving from the oscillator to the antenna). If the tilt angle of the directional coupler is changed by 180°, the instrument shows only the power of the reflected (i.e. moving from the antenna to the oscillator) wave. The attenuation of the directional coupler is within the limits of 37 - 41 db. The exact value is written on the body of unit АПС.

H.F. Units

H.F. unit ША-50 differs from unit ША-02 in that it includes H.F. amplifier unit МВ-50 with signal channel mixer СП-05 and also units БП-140 and БП-52 meant for supplying unit МВ-50.

Units МВ-50 and БП-140 are secured on the cabinet of unit ША-50, and unit БП-52, on the cabinet of ШУ-50.

The key diagram of unit ША-50 with specifications is given in Appendix 2.

The description of units МВ-50, БП-140 and БП-52 and also the diagram of interaction between the H.F. amplifier and the receiving equipment are given in a separate book attached to this supplement, and the description of unit СП-05 is given below.

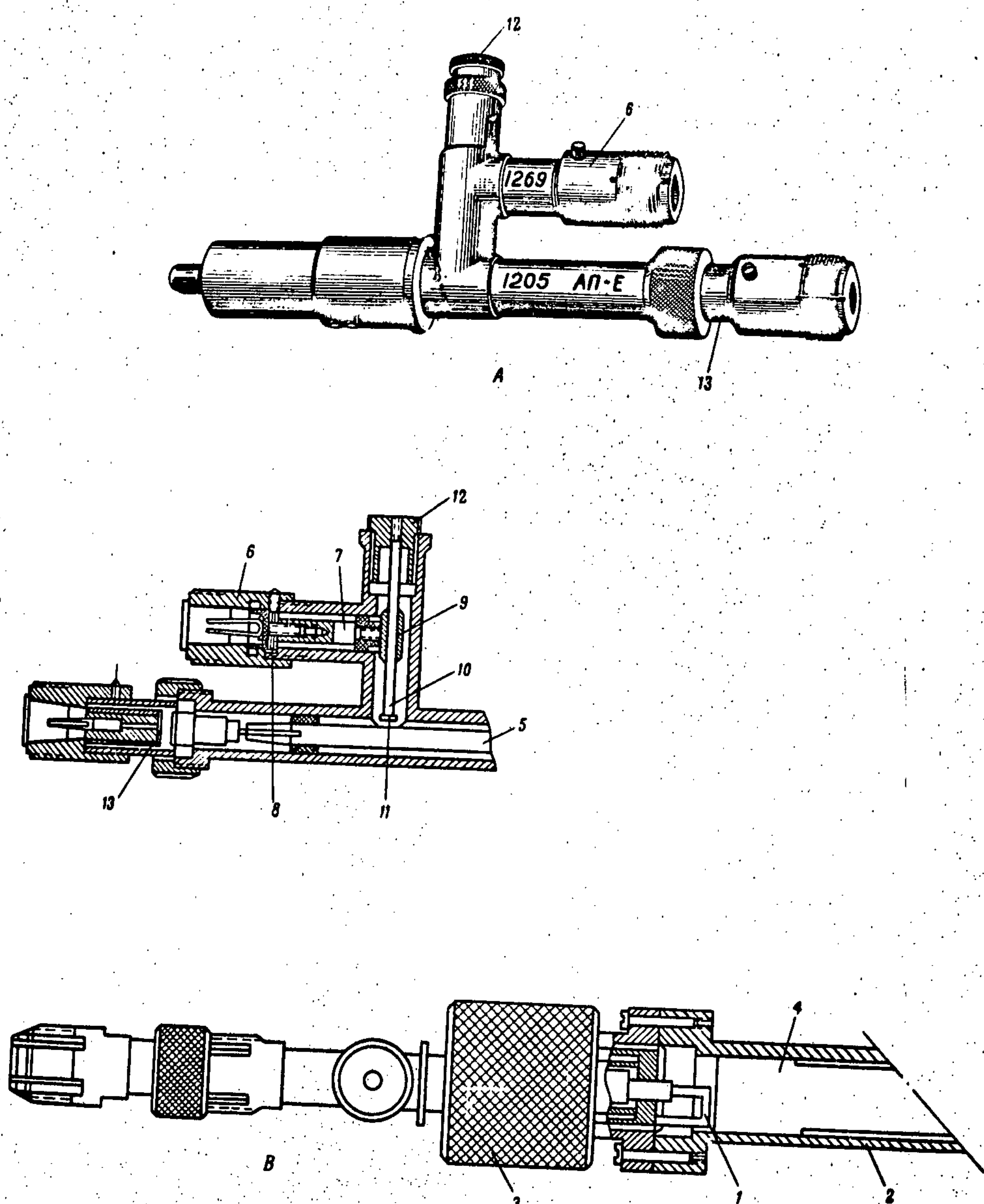


Fig. 29. A.F.C. Channel Mixer

A-General view; B-Section view; 1-coupling loop; 2-cylindrical tube; 3-collet; 4-plates with absorbing layer (attenuator); 5-inner conductor; 6-connector for supplying voltage from heterodyne; 7-inner spindle; 8-gasket with absorbing layer; 9-T-joint; 10-rod; 11-end piece; 12-coupling rod nut; 13-quarter-wave filter

Signal Channel Mixer (СП-05)

The signal channel mixer (Fig.28) is an input stage of the receiver and serves for mixing the frequency of the incoming signal and the heterodyne frequency so as to obtain the intermediate frequency.

The mixer is a coaxial circuit which employs the crystal germanium detector, type ДГС-2, ДГС-3 or ДГС-4 . This circuit is connected with the toroidal circuit of the discharger (See Fig.28) through slot 1. The discharger toroidal circuit is rigidly connected with the waveguide section of the transmit-receive switch. From the waveguide the energy is propagated through the toroidal circuit and acts upon the inner conductor of the mixer coaxial circuit.

The inner conductor of the mixer is fitted with two cylinders 3 and 4 serving as quarter-wave filters for the waves of higher harmonics (3 and 5 cm.). Supplied to the mixer coupler via the connector is the voltage of the heterodyne with the frequency differing from the signal frequency by 30 Mc/s. A special device provides for coupling with the heterodyne.

Inner spindle 5 of the H.F. input, secured on washer 6, is connected through T-joint 7 with movable rod 8 terminating in an end piece. The end piece of rod 8 being placed at a short distance from the inner conductor 2 of the mixer ensures capacitive coupling.

The gap between the end piece and inner conductor 2 may be adjusted by means of nut 9 rigidly connected with rod 8.

The rod is fixed with lock nut 10.

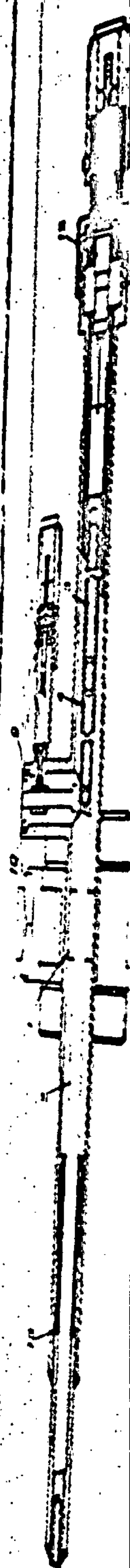
The plug connector of the H.F. input of the mixer is fitted with special pertinax washer 11 with an absorbing layer. It balances the mixer input and the klystron output. The washer resistance (from the coaxial central conductor up to the external wire) is equal to cable characteristic impedance, i.e. 50 ohms.

Piston 13 with a quarter-wave cavity is located at the opposite end of the coaxial line.

The piston is set in such a position that the coaxial circuit of the mixer is tuned in resonance. After setting, the piston is soldered.

The intermediate frequency is taken off from the detector by means of a special plug connector. The latter is fitted with a special quarter-wave filter preventing the high frequency from getting to the input of the H.F. amplifier.

To ensure the protection of the discharger, provision is made for a keep-alive electrode which serves to initiate pre-ionization of gas in the electrode. The firing voltage of 825±30 V is delivered from special rectifier ЯП-01 (plus to the body, minus to the keep-alive electrode). To limit the current, a resistor of 3.9 megohms is included in the firing circuit. This resistor is included directly at the keep-alive electrode to prevent parasitic oscillations.



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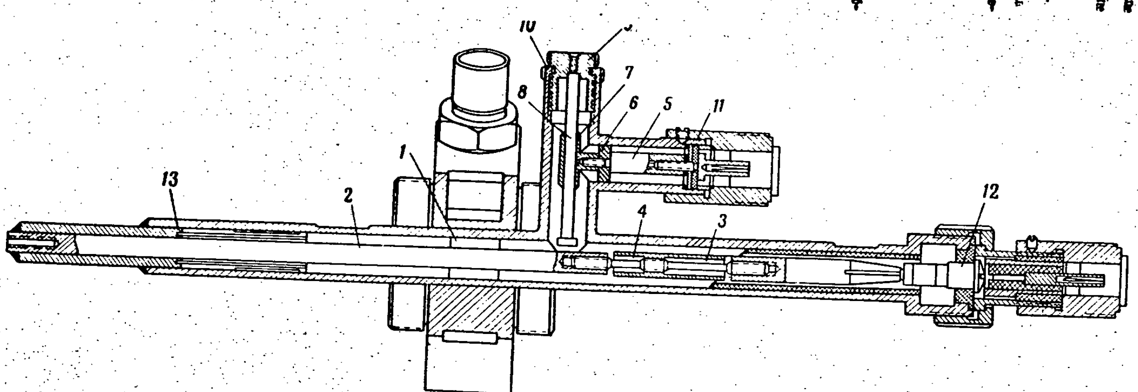

Fig. 28. Reflected Signals Mixer

1-coupling slot; 2-inner conductor; 3 and 4-cylinders of inner conductor; 5-inner spindle of H.F input, 6-washer; 7-T joint, 8-movable rod; 9-nut, 10-locknut; 11-gasket, 12-detector, 13-piston

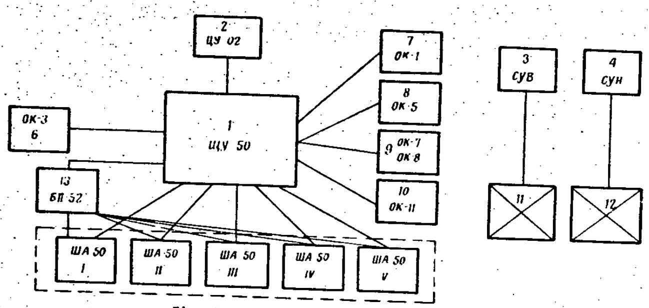

Fig. 99. Block Diagram of Control System

1-local control cabinet; 2-central control panel, 3-control desk arranged in the indicator equipment truck control cabinet, 4-control desk arranged in the height indicator cabinet, 5-HF units, 6-cabin rotation electromotor, 7-cabin fan electromotor; 8-storage batteries of cabin emergency illumination, 9-cabin illumination light; 10-cabin electric heater, 11-vertical-beam reflector swing mechanisms; 12-slant-beam reflector swing mechanisms; 13-unit for supplying units ШВ 50

CONTROL SYSTEM

23. PURPOSE AND BLOCK DIAGRAM

Para.69. Purpose of the System

The control system allows for switching on and off the corresponding equipment in a certain sequence. Switching may be performed both in situ (i.e. in the rotating cabin) and remotely from the central control panel (i.e. from the second truck). If troubles appear, the corresponding elements of the equipment are automatically switched off.

The control system is provided with supervisory elements which allow for checking the operation of the station and the transceiver and for detecting troubles.

Para.70. Block Diagram

The block diagram of the control system is shown in Fig.99.

The whole system may be subdivided into the following separate systems:

- the control system of the transceiver;
- the control system of the cabin electromotor;
- the control system of reflector tilt;
- the control system of the auxiliary test equipment.

The equipment of the control system is contained in units ШУ-50 (Fig.100) and ШУ-02 (Fig.101).

Changing-over from the local control to the remote control is effected with the help of special switch ШУ-19 located in unit ШУ-50 . The system is energized from the 220 V, D.C. mains.

The key diagram of the central control panel and its specification are given in Appendix 3.

The key diagram of the local control cabinet and its specification are given in Appendix 4.

Para.71. Purpose of the Control System of the Transceiver

The control system of the transceiver is meant for energizing the manipulator and H.F. units only in the following sequence:

- the energy is delivered to the magnetron filaments, to the rectifiers of firing voltage and receivers, to the magnetron and waveguide fans, to unit ГА-01 and also to rectifier БП-52 (to supply the coils of H.F. amplifier unit МВ-50) and supply unit БП-140 (to supply the filament of the travelling-wave tube);
- in 2 - 3 minutes, when the magnetron filament is heated up, reduced anode voltage is supplied (preliminary switching);
- in two more minutes full operating voltage is fed to the magnetron anodes and the mag-

netron filament voltage is reduced two times; the anode voltage of the travelling-wave tube is switched on.

The commutation in the above sequence is possible both in case of local and remote control. The remote control allows only for automatic and complete switching.

In addition to energizing the transceiver, the control system provides for:

- protection of units and automatic deenergizing of the equipment in case of breakdowns, overloads, etc.;
- trouble-free operation of the station, when one of the transmitters is out of order;
- deenergizing of the whole transceiver equipment if two or more transmitters are out of order;
- signalling when the most important circuits and interlocks are switched on and off and in case of breakdown;
- checking of magnetron anode currents.

Para.72. Purpose of Control System of the Cabin Electromotor

The control system of the cabin electromotor serves for:

- starting and stopping the electromotor;
- rotating the cabin with a speed of 6 and 3 r.p.m. by switching over the electromotor windings;
- automatic switch-over of the electromotor windings when using the speed of 3 r.p.m. instead of 6 r.p.m.; this occurs at the moment when the number of revolutions corresponds to the 3 r.p.m. speed of the cabin rotation;
- forced delivery of the warning signal before starting the electromotor; duration of the signal is set by the operator, but for the safety purpose it should not be less than 30 sec.

Para.73. Purpose of the Reflector Tilt Angle Control System

The control system of the vertical reflector tilt angle is similar to that of the slant reflector tilt angle.

The control system of the slant reflector angle serves for:

- remote starting and stopping the electromotor (the electromotor local control is not provided);
- reversing the electromotor;
- controlling the reflector tilt angle.

Para.74. Purpose of Test Equipment Control System

The test equipment control system serves for:

- starting and stopping the electromotor of the cabin fan and heater;
- switching on and off the operating and emergency illumination of the cabin;
- checking the line voltages and the voltage across the output and in the winding of the increased frequency generator exciter.

24. KEY DIAGRAM OF CONTROL SYSTEM

Para.75. Transceiver Control System

As was stated above, the transceiver may be energized from two units (ШУ-50 or ШУ-02).

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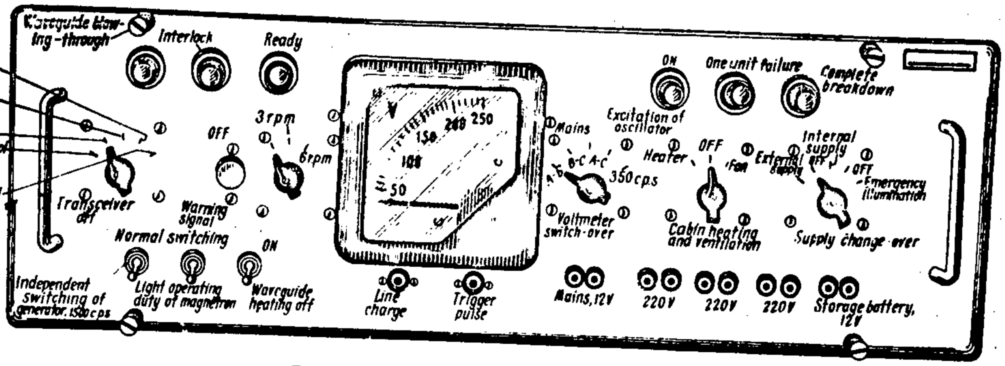

Fig. 100. Panel of Unit ЩУ-50. General View

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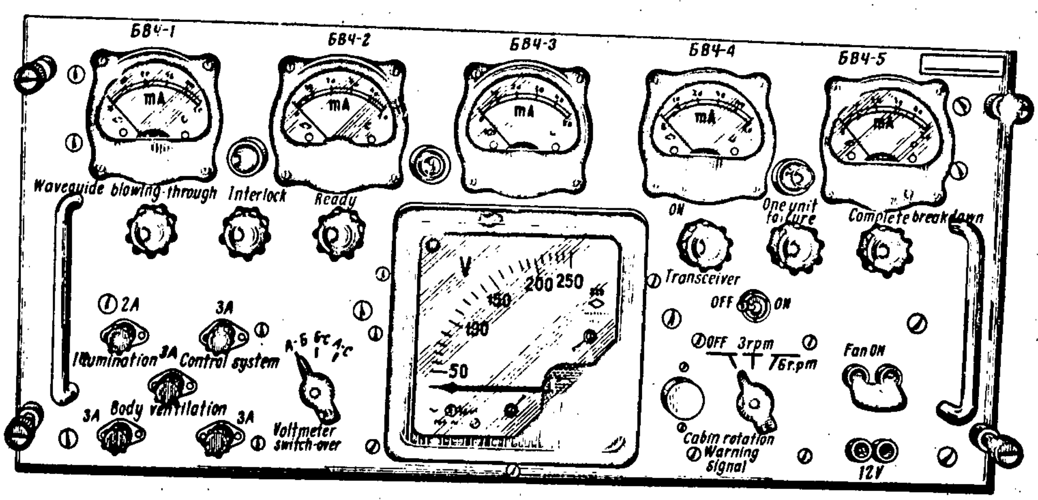

Fig. 101. Central Control Panel ЦУ-02.
General View

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Given below is the operation principle of the system when the local cabinet range is controlled; this arrangement is found the most advantageous in the description of the diagram.

The key diagram of the control system is given in Appendix No.6.

The system is changed over from the local control to the remote control and vice versa by means of switch ШУ-19 TRANSCEIVER ON - (ВКЛ.ПР.-ПЕРЕД-АПП) located on unit control panel ШУ-50 , Five section switch ШУ-19 (sections ШУ-19) has five positions:

Position No.1 REMOTE CONTROL (ДИСТ. УПР.)

Position No.2 - OFF (ВЫКЛЮЧЕНО)

Position No.3 - BLOWING THROUGH (ПРОДУВ) - blowing through the waveguide

Position No.4 - READY (ПРЕДВАР.ВКЛЮЧ.) - preliminary switching

Position No.5 - ON (ПОЛН.ВКЛ.) - full switching.

When switch ШУ-19 is set in position 1, the equipment may be energized from the central control panel by means of switch ШУ-58 . With the switch placed in position 2, the whole system is completely switched off.

With switch ШУ-19 set in positions 3, 4, 5 the local control is used for switching on the equipment. For switching on the transceiver switch ШУ-19 may be gradually shifted from one position to another or set directly in position ON (ПОЛН.ВКЛ.).

In this case the sequence of commutation and time delay are retained.

Switching on the waveguide blowing system. Switch ШУ-19 is set to position BLOWING THROUGH. This causes winding ШУ-14/1 of the contactor electromagnet of circuit-breaker ШУ-14, type АДЗх15 , to be energized. The energy is supplied to winding ШУ-14/ via the circuit: phase "a", fuse ШУ-35 , switch ШУ-19/1 (position 3), winding ШУ-14/1 , emergency relay contact ШУ-12/3-4 , phase "c".

Simultaneously with energizing winding ШУ-14/1 , motor-type time relay ШУ-18 is switched on. The supply circuit of the motor relay is as follows: phase "a", fuse ШУ-35 , switch ШУ-19/1 (position 3), normally closed relay contact ШУ-68/4-5 , winding ШУ-18/1 of the coupling clutch electromagnet, contact ШУ-14/3-4 , emergency relay contact ШУ-12/3-4 , phase "c".

The electromagnet of contactor ШУ-14 closes its main contacts ШУ-14/2 which serve for energizing the electromotor of fan ШУ-61 of unit ШУ-50 , windings ША-34/1 of contactors ША-34 , type АДSх5 , unit БП-52 , and lamps ШУ-6 and ШУ-7 , indicating that the blowing-through process takes place. Main contacts ША-34/2 switch on the firing voltage rectifiers, the receiver, the travelling-wave valve filament, the electromotors of fans ША-27, ША-28 and magnetron heater transformers ША-25 .

The supply circuits of the firing voltage rectifiers, of the receiver and the travelling-wave valve filament are protected by separate safety fuses. The magnetron heater circuits are protected by safety fuse ША-36 , and the circuits of autotransformer ШУ-32 , by safety fuses ШУ-37.

The supply circuits of the electromotor of fan ШУ-61 are protected by safety fuses ШУ-38, ШУ-39, ШУ-40.

The supply circuits of the electromotors of fans ША-27 , ША-28 are protected with centrifugal relays ЦР.

Contact ШУ-18/4 operates 30 - 40 sec. after motor-type time relay ШУ-18 is switched on. The voltage is fed to relay winding ШУ-68/1 through the following circuit: phase "a", safety fuse ШУ-35 , switch ШУ-19/1 , contact ШУ-18/4 , winding ШУ-68/1 , emergency relay contacts ШУ-12/3-4 , phase "c".

Relay ШУ-68 operates and with its contacts ШУ-68/4-5 opens the supply circuit of the coil of motor-type time relay ШУ-18 and interlocks contact ШУ-18/4 ; as a result, the voltage will be fed to relay winding ШУ-68/1 through the following circuit: phase "a", safety fuse ШУ-35, switch ШУ-19/1 , contact ШУ-68/4-5, winding ШУ-68/1 emergency relay contact ШУ-12/3-4, phase "c".

Relay contact ШУ-68/6 after being closed, prepares the protection system for operation. The coils of motor-type time relay ШУ-18 are energized through the short-circuited contact of contactor ШУ-30.

The time delay of 30 - 40 sec. (from the beginning of switching the station up to the moment the protection system is ready for operation) is needed for opening the contacts of the centrifugal relays after the fan electromotors gain the nominal speed of rotation (the closed contacts of the centrifugal relays cause operation of the protection system). The protection system becomes ready for operation since less time is needed to close contact ШУ-68/4-5 than to open motor-type time relay contacts ШУ-18/4.

To prevent the operation of the transceiver with the protection system being unprepared, supply circuits of motor-type time relay ШУ-17 and of the windings of the electromagnets of contactors ШУ-29, ШУ-30 (containing unit, type ВПЛ-12) are provided with contacts ШУ-68/2-3.

The motor-type time relay (ШУ-17 and ШУ-18) has preheaters ШУ-17/8 and ШУ-18/8, since the induction electromotors do not operate properly at the temperatures below +5°C. The preheaters are switched on automatically with the help of thermal bimetallic strip relays ШУ-17/9 and ШУ-18/9.

The preheating circuits are protected by safety fuses ШУ-36 . Preheating is switched off at a temperatune of about +15°C.

Preliminary Switching of the Station

During the preliminary switching motor-generator set ВПЛ-12 is started, and the necessary preparation is done for switching on the high voltage.

ВПЛ-12 set is put into operation by means of three-phase squirrel-cage induction motor.

When the motor is fed directly from the 220 V mains, its starting current exceeds 300 A. At such a value, ВПЛ-12 set cannot be started from unit АЛД-60 of the power station, because the voltage across the terminals of the power station generator may be reduced by 50 per cent of its nominal value, which is not permissible.

To limit the value of the starting current, a star connection and then a delta connection of the electromotor winding are used when ВПЛ-12 set is started.

When the stator winding is star-connected, the value of the starting current is reduced three times.

When switch ШУ-19 is set to position READY, winding ШУ-86/1 of the contactor electromagnet is energized. Winding ШУ-86/1 is fed through the following circuit: phase "a", safety fuse ШУ-35, switch ШУ-19/2 , winding ШУ-86/1. emergency relay contact ШУ-12/3-4, phase "c".

After operating, contactor ШУ-86 closes its main contacts ШУ-86/2 which serve for supplying voltage to the open winding of ВПЛ-12 set.

Simultaneously with the main contacts interlock contacts ШУ-86/3-4 are also closed; they close the supply circuit of contactor windings ШУ-29/1 and the windings of motor-type time relay ШУ-17.

Winding ШУ-29/1 is energized through the following circuit: phase "a", safety fuse ШУ-35, switch ШУ-19/2 , contacts ШУ-86/3-4 , ШУ-14/3-4 , ШУ-68/2-3 , winding ШУ-29/1 , contacts ШУ-30/3 , ШУ-17/4-5 , ШУ-12/3-4 , phase "c".

After operating, contactor ШУ-29 closes its main contacts ШУ-29/2 which serve for star-connecting the winding of ВПЛ-12 set.

30 - 40 sec. after motor-type time relay ШУ-17 is switched on, contact ШУ-17/4-5 operates, and the voltage is taken off from contactor winding ШУ-29/1 to winding ШУ-30/1.

After operating, contactor ШУ-30 connects the stator winding of ВПЛ-12 set in delta through its main contacts ШУ-30/2.

To provide for electrical interlock of contactors ШУ-29 and ШУ-30 , normally closed contact ШУ-30/3 is employed in the supply circuit of the winding of contactor ШУ-29 , and normally closed contact ШУ-29/3 , in the supply circuit of contactor ШУ-30.

115 - 140 sec. after motor-type time relay ШУ-17 is started, its contacts ШУ-17/6 and ШУ-17/7 are closed.

Contact ШУ-17/6 prepares contactor ШУ-16 for switching, while contact ШУ-17/7 switches on lamps ШУ-3 and ШУ-9 indicating the preliminary switching.

10 - 15 sec. after contacts ШУ-17/6-7 are closed, normally closed contact ШУ-17/3 operates and takes off the voltage from the winding of the electromotor of the motor-type time relay (ШУ-17/2).

Full Switching of the Station

For full switching of the station switch ШУ-19 is set in position ON.

The full switching is possible only if the doors of units ША-50 and МН-02 are closed, because the interlock contacts of these cabinets are series-connected into the supply circuits of contactor ШУ-16.

When the doors of cabinets ША-50 and МН-02 are closed (interlock contacts are closed), lamps ШУ-4 and ЦУ-8 marked INTERLOCK (БЛОКИР.) light up.

Two duties of full switching may be used in the station, light operating duty of magnetrons and normal operating duty. The first duty is used for adjustments. The anode voltage is reduced in this case, and the heater voltage is increased.

To switch the station to the light operating duty, switch ШУ-26 is set in position LIGHT OPERATING DUTY (ОБЛЕГЧ.).

The supply circuit of motor-type time relay ШУ-18 is opened.

When switch ШУ-19 is placed in position ON contactor ШУ-16 operates, its main contacts ШУ-16/2 connect the load to the increased frequency oscillator.

The voltage across the oscillator output is adjusted by rheostats ШУ-57 and ШУ-58, which are inserted into the circuit of the excitation winding.

The anode currents of the transmitters are measured by milliammeters ША-4 and ЦУ-2-6.

To switch over the station to the normal operating duty, close the contact of switch ШУ-26. In this case motor-type time relay ШУ-18 is cut in because contactor ШУ-16 operates when switch ШУ-19 is placed to position ON and its contact ШУ-16/4 is closed.

100 - 120 sec. after the motor-type time relay is cut in, contact ШУ-18/5 is closed and contactor ШУ-13 , type АЛ3х56/3 , is switched on.

Contactor ШУ-13 supplies reduced heater voltage through its contact ШУ-13/2 and short-circuits part of resistor ШУ-58 with its contact ШУ-13/3.

The excitation current increases and, therefore, the voltage across the increased frequency oscillator output rises, 15 - 20 sec. later contact ШУ-18/6-7 cuts in the anode supply of TW valve and lamps ШУ-5 and ЦУ-10 indicating the full switching of the station.

Operation of the Station Protective Devices

If one of H.F. cabinets ША-50 is damaged, it can be switched off and its charging line may be connected to the load equivalent (one unit is damaged).

If two cabinets ША-50 are damaged, supply of the whole transceiver equipment is cut off.

To protect each H.F. unit ША-50 , the following elements are used:

- H.F. circuit-breaker МН2-6;

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- relay ША-6 in the magnetron anode circuit;
- centrifugal relays ША-29 and ША-30 installed on fans ША-27 and ША-28.

Failure of one unit ША-50. If the blower fan stops operating, the equipment is overheated and put out of operation. The reduction of the magnetron anode current of one of the magnetron oscillators results in higher voltage across the pulse transformer output, which leads to damage of the latter or of the magnetron.

Besides, this causes a change in the operating conditions of the resonant transformer, thus impairing the operation of other units.

Therefore, when mounting the fans, or when one of the magnetrons is faulty, connect the charging line of this unit to the load equivalent so as not to disturb the operating conditions of the resonant transformer.

This is performed with the help of H.P. circuit-breaker whose electromagnet (MH2-6/1) is energized when the contacts of relay ША-6 or of centrifugal relays ША-29 and ША-30 are closed.

The H.P. circuit-breaker breaks with its contact MH2-6/2 the supply circuit of its own electromagnet and:

- cuts in the supply of lamps ШУ-01 and ШУ-11 indicating failure of one unit through contact MH2-6/3;
- closes contact MH2-6/7 and opens contact MH2-6/5. Contact MH2-6/7 is inserted into the circuit of the winding of relay ШУ-12;
- operates contacts MH2-6/7 and MH2-6/8 in the circuit of the winding of relay ШУ-12 so that after operation of one H.P. circuit-breaker MH2-6, the winding of the relay is not energized.

When any two of the circuit-breakers operate (MH2-2, MH2-3, MH2-4, MH2-5, MH2-6), the winding of relay ШУ-12 becomes energized and the relay operates.

The deenergized position of the H.P. circuit-breaker can be easily identified by the reset handle brought out to the front panel of unit MH-02. After the fault is eliminated, the circuit-breaker is switched on manually.

Failure of two units ША-50. If two units ША-50 are faulty, two H.V. circuit-breakers MH2 operate, and the winding of relay ШУ-12 is energized.

Relay ШУ-12 operates and by its contacts ШУ-12/3-4 takes off the voltage from the windings of contactors and relays ШУ-14, ШУ-29, ШУ-30, ШУ-86, ШУ-17, ШУ-18, ШУ-16 which cut off the supply of the whole transceiver equipment.

Lamps ШУ-12 and ШУ-2 indicating the failure of the equipment (complete breakdown) are switched on simultaneously.

Having operated, relay ШУ-12 is interlocked by contact ШУ-12/2 and remains in the ON position until switch ШУ-19 is set in position OFF.

Apart from the above-described protection system, contactors ШУ-14, ШУ-16, ШУ-86 are provided with maximum thermal protection against short-circuits and overloads.

If the amount of the consumed current exceeds the rated value and in case of short-circuits, the circuit-breaker disconnects the protected line; in the first case it is done after a certain period of time determined by the overload value and by the efficiency of the thermal protection and in the second case, instantaneously.

If circuit-breaker ШУ-16 operates, the high voltage is cut off.

The signal contact of circuit-breaker ШУ-16/4 is closed, switching on lamps ШУ-2 and ШУ-12 which indicate the failure of the station (complete breakdown). Simultaneously, due to opening of contact ШУ-16/3, motor-type time relay ШУ-18 is deenergized, its contacts return to the initial position, breaking the supply circuits of the electromagnets of antenna switches АП-1/1 and lamps ШУ-10 and ШУ-5 which go out indicating that the high voltage is cut off.

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When circuit-breaker ШУ-14 operates, the supply of magnetron heaters, receivers, time relays and fans is disconnected.

Signal lamps COMPLETE BREAKDOWN (ПОЛН. АВАРИЯ) are switched on by signal contact ШУ-14/5. Signal lamps READY and ON go out because their supply circuits are broken.

After the relay of contactor ШУ-86 operates, the electromotor of motor-generator set ВПЛ-12 is deenergized, and the windings of emergency relay ШУ-12/1 are fed with voltage through contact ШУ-86/6.

Upon operation, relay ШУ-12 stops with its contacts ШУ-12/3-4 the supply of the transceiver equipment control system.

Para.76. Cabin Rotation Motor Control System

The cabin is rotated by the motor, type А61-8-4,(three-phase, 220 V, two-speed, 720 r.p.m. and 1450 r.p.m.).

The speed of rotation is changed by switching over the motor windings from the delta to double-star connection.

The motor speed of 720 r.p.m. corresponds to the cabin rotation speed of 3 r.p.m., and the motor speed of 1450 r.p.m. corresponds to the cabin rotation speed of 6 r.p.m.

Switching On the Motor Adjusted for 720 r.p.m.

Consider the switching procedure from the ШУ-02 central control panel. Switch ШУ-19/4 is set in position REMOTE CONTROL (ДИСТ. УПРАВ.) and switch ШУ-54 to position 3 r.p.m.

Switch ШУ-54 may be set only after pressing push-button ШУ-64 which is mechanically connected with the switch.

Push-button ШУ-64 closes the supply circuit of the warning signal winding (marked OK-16 in the diagram). The signal is applied only with the push-button pressed.

When switch ШУ-54 is set in position 3 r.p.m., the winding of circuit-breaker ШУ-15, type АД3х15 , is supplied via the following circuit: phase "a", safety fuse ШУ-59 , switch ШУ-54 (position 3 r.p.m.), slip ring of rotary joint 42, switch ШУ-19/4 (position 1), contact ШУ-9/3 , winding ШУ-15/1, contact ШУ-87/3 , contact OK-4 of centrifugal relay ШР-2, contacts OK-14 and OK-13 (interlocks of the hand-operated drive and the cabin locking system), phase "c".

Contactor ШУ-15 operates and through its main contacts energizes the delta-connected windings of the motor. Simultaneously, contact ШУ-15/4 closes interlocking contact OK-4 of the centrifugal relay, since contact OK-4 opens at 600 - 700 r.p.m.

Switching On the Motor Adjusted for 1450 r.p.m.

Switch ШУ-54 is set to position 6 r.p.m. The speed of 1450 r.p.m. is obtained by correspondingly changing over its windings. This is effected by means of circuit-breaker ШУ-87, type АД3х356/3 , and circuit-breaker ШУ-9 , type АД3х15.

The windings of the above circuit-breakers are supplied through the circuit: phase "a", safety fuse ШУ-59 , switch ШУ-54 (position 6 r.p.m.), slip ring of rotary joint 44, ШУ-19/5 (position REMOTE CONTROL), ШУ-9/1 and ШУ-87/1, ШУ-15/3-4, OK-13 and OK-14, phase "c".

Circuit-breakers ШУ-9 and ШУ-87 operate and by their main contacts switch over the electromagnet windings.

Change-Over from 1450 r.p.m. to 720 r.p.m.

Switch ШУ-54 is placed to position 3 r.p.m. The voltage is taken off from the electromotor winding, because contacts ШУ-87/2 and ШУ-9/2 are open. The electromagnet continues rotating under the inertia force, and with the speed of rotation reduced down to 600 - 700 r.p.m. contact OK-4 of the centrifugal relay is closed. The winding of circuit-breaker ШУ-15 is energized, the latter operates and delivers supply to the electromagnet winding. Due to this, the speed of cabin rotation becomes equal to 3 r.p.m.

The motor is switched on by shifting switch ШУ-54 to position 1 (OFF).

The electromagnet is controlled from the panel of the local control cabinet in the way already described by means of switch ШУ-54 and push-button ШУ-28.

The diagram provides for mutual electrical interlock of circuit-breakers ШУ-9 , ШУ-87, and ШУ-15 , and also the interlock of the hand-operated drive and the cabin lock (OK-13 and OK-14).

Because of the electrical interlock, circuit-breakers ШУ-15 , ШУ-9 and ШУ-87 cannot be switched on simultaneously.

The interlock is effected by means of contacts ШУ-9/3 , ШУ-87/3 and ШУ-15/3-4.

With the hand-operated drive interlocked, the electromotor cannot be started by manually rotating the cabin since interlocking contact OK-13 opens in this case. Safety fuses ШУ-59 and ШУ-35 serve for protection of the supply circuits. Besides, circuit-breakers ШУ-9 and ШУ-15 are provided with maximum thermal protection. The electromotor control equipment is located in unit ШУ-50.

Para.77. Reflector Tilt Control System

To change the direction of the antenna reflector radiation, shift the swing mechanism relative to the initial position. For tilting, make use of a jack. The main drive of the jack is of the motor type. The hand-operated drive serves for initial setting of the reflector.

Both the slant and vertical beam reflectors are similarly controlled and operated.

The reflector tilt is controlled by means of switches СУВ-13 and СУН-13 from the antenna swing control desks.

One phase is constantly connected to the motors of the tilting mechanisms through safety fuses ШУ-82 and ШУ-83 located in cabinet ШУ-50 . The other two phases are applied to the motors by switches СУВ-13 and СУН-13 through the safety fuses.

The setting of switches СУВ-13 and СУН-13 from position HIGHER (ВЫШЕ) to position LOWER (НИЖЕ) changes the sequence of the phases applied to the motor winding, i.e. changes the direction of the motor rotation.

When the reflectors reach the extreme operating positions - 3.5° to $+4^{\circ}$, special devices arranged in the tilting mechanism reduction gears are switched on. They disengage the central screws connected with the reflectors from the rotating motors. Lamps СУВ-14 and СУН-14 located on the reflector swing control desks indicate that the motors of the reflector tilting mechanism operate properly.

To transmit the reflector tilt angle to truck No.2, a remote transmission system is used. The rotor of the transmitting selsyn is connected with the reflector shaft through the transmission gear with a ratio of 1:20.

Electrically connected with the transmitting selsyn is the receiving selsyn located on the control desk of truck No.2; the receiving selsyn shows the reflector tilt angle.

The stators of transmitting selsyns СД-02 and СД-03 are supplied with A.C., 110 V, 50 c.p.s. The supply voltage is delivered from transformers ШУ-84 and ШУ-85 arranged in unit ШУ-50 . The primary circuit of the transformers has safety fuse ШУ-81.

The stators of the receiving selsyns are energized from transformers СУВ-10 and СУН-8.

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Para.78. Control System of Auxiliary and Measuring Equipment

The auxiliary equipment (the motor of the cabin fan, cabin heaters, cabin illumination and sockets for 12 V and 220 V may be supplied both through the slip ring (internal circuit) and through a special connector (external circuit) arranged in junction box ПК-02 of the vertical reflector.

When the slip ring is repaired the auxiliary equipment is supplied through the external circuit.

The supply is switched over from the internal to external circuit with the help of switch ШУ-22.

Cabin Ventilation

The cabin is ventilated by means of an exhaust fan actuated by A.C. electric motor OK-1.
The cabin ventilation is started by switch ШУ-23.
With the fan switched on the cabin heating system is cut off.
The fan supply circuits are protected with safety fuses ШУ-76, ШУ-77, ШУ-78.

Cabin Heating System

The cabin is heated with electric heater OK-11, which is cut in by switch ШУ-23.
The heater supply circuits are protected with safety fuses ШУ-79 and ШУ-80. With the cabin heating system switched on, the fan is cut off.

Cabin Illumination

The cabin illumination system is energized from the A.C. mains through step-down transformer ШУ-31, 220/12 V.

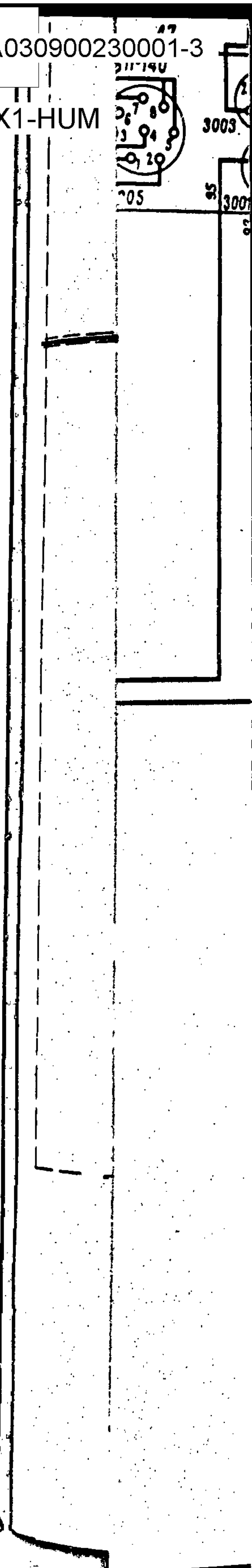
The emergency illumination is provided from 12 V storage battery OK-5. The storage battery circuit has safety fuse OK-18. Change-over from the mains supply to the storage battery supply is effected with the help of switch ШУ-22.

To switch on the lamps of the cabin illumination, close the cabin door, close the door interlock switch OK-6 and cut in illumination switch OK-17 located above the door.

Mains socket ШУ-50/12 V and storage battery socket ШУ-51/12 V serve for switching on portable lamps, soldering irons, etc. Besides, provision is made for sockets ШУ-24, ШУ-25 and ШУ-49 having the voltage of 220 V.

Measuring of Voltages

In the transceiver the voltage may be measured between the phases of the mains (220 V, 50 c.p.s.), across the excitation winding (D.C., 110 V), and across the output of the increased frequency oscillator (220 V, 350 c.p.s.). The check-up is performed by means of voltmeter ШУ-7, type Э-30, located on the control panel of cabinet ШУ-50. The latter is connected to the corresponding circuits by switch ШУ-20.



INSTRUCTIONS ON COMPENSATION OF OUTPUT VOLTAGES OF RECEIVERS IN UNIT СБ-50

I. Preparation of Unit СБ-50 for Compensation of the Output Voltages

1. Set tumbler switch BLANK ON (ВКЛ. БЛАНКА) of unit СБ-50 in position OFF.

2. Set the central switch in position CALIBRATION 2 V (КАЛИБРОВКА 2В) and set the calibration voltage equal to app. 10 mm on the reference oscillograph by means of adjusting screw OSCILLOGRAPH AMPL. (УСИЛЕНИЕ ОСЦИЛЛОГРАФА).

3. Set the tumbler switches of the receivers to position ON.

Checking in succession the receivers output at the unit input, set the noise level for both receivers equal to 1 V.

4. Set the switches of the receivers to position OFF, put the screws of compensation of vertical and slant receivers (on unit horizontal panel) to the extreme left position.

5. Set the central switch to position OUTPUT BEFORE CUTOFF (ВЫХОД ДО ОТСЕЧКИ).

Set the OVERALL GAIN knobs of the vertical and slant channels to the extreme right position.

II. Compensation of Receiver Output Voltages

1. Set the switch of the reference oscillograph to position VERTICAL(ВЕРТ.).

2. Put the switch of the lower vertical receiver to position ON. Rotate the compensation adjusting screw of the lower vertical receiver to the right (on the horizontal panel of the unit) till the noise level stops rising on the screen of the reference oscillograph. Set the receiver supply switch to position OFF. The adjustment of the normal compensation of the given receiver is completed.

3. The compensation of other receivers of the vertical channel is performed in the way described above with the help of the corresponding adjusting screws.

4. Successively switching on the receivers of the vertical channel, check the noise level at the output before cutoff.

With the noise level at the input of unit СБ being the same, the receivers have approximately identical noise levels.

5. Put the switch of the reference oscillograph to position SLANT (НАКЛ.) and perform the compensation of the slant receivers in the way described for the receivers of the vertical channel.

The compensation of the output voltages should be checked during the weekly preventive maintenance as instructed in Section II, Item 4 both for the vertical and slant channels.

If the compensation of the output voltages is correctly adjusted, the noise level at the output before the cutoff should be the same, Otherwise, repeat the compensation of these channels. If this fails to level the noise at the output before cutoff, replace the diode or eliminate the trouble in the compensation circuit of this channel.

After the output voltages of the receiver are balanced, set the normal noise level at the output before cutoff and at the output of unit СБ-50.

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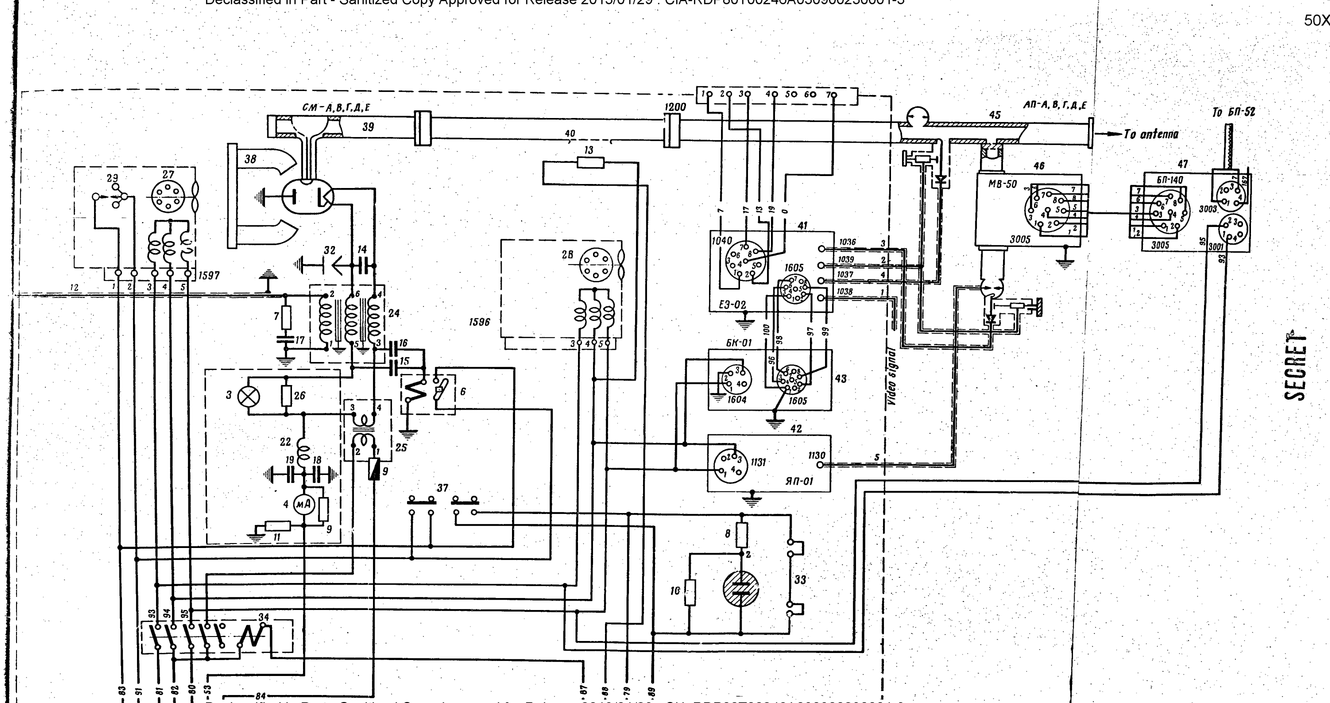

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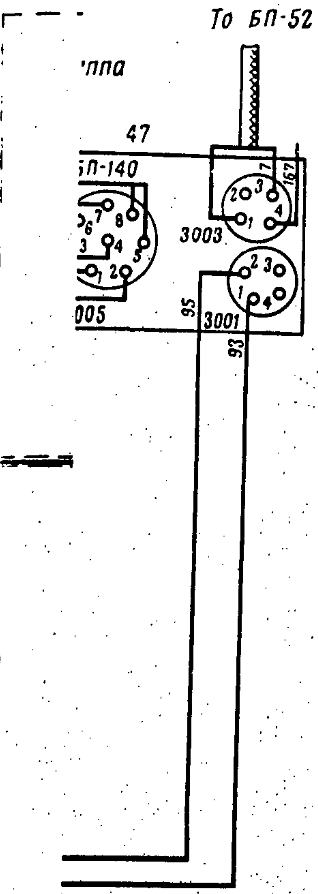

Connector 1605

1	100	Earthing
2	–	
3	96	220 V
4		
5	97	220 V
6	98	+300 V
7		
8	99	-260 V

Connector 1040

Pin No.	Wire No.	Circuit
1	7	L.A.G.C. relay
2	13	Differential relay
3		
4	0	Earthing
5		
6		
7	17	Intensification
8	19	Gain control

Connector 1604

1	95	220 V
2		Earthing
3	94	220 V
4		

Terminal block 1200

1	7	L.A.G.C. relay
2	13	Differential relay
3	17	Intensification
4	19	Gain control
7	0	Earthing

Terminal block 1198

1	83	Centrifugal relay
2	91	Centrifugal relay
3	81	220 V
4	82	220 V
5	80	220 V
6	53	Magnetron current
7	84	220 V

Terminal block 1199

1	87	Contactor winding
2	88	220 V
3	79	Interlock
4	89	Interlock
5		
6		
7		

Connector 1131

1	95	220 V
2		
3	94	220 V
4		

Connectors: 1036; 1037, 1038; 1039; 1130

1	3	I.F.A. PK-47
1	4	A.F.C. mixer PK-47
1	1	Output of receiver PK-31
1	2	Heterodyne PK-47
1	5	800 V - ПВ-ЛЗ-2

Pin No.
1
2

Pin No.
1
2
3
4
5
6
7
8

Pin No.	W
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SECRET

Terminal block 1200		
1	7	L.A.G.C. relay
2	13	Differential relay
3	17	Intensification
4	19	Gain control
7	0	Earthing

Terminal block 1198		
1	83	Centrifugal relay
2	91	Centrifugal relay
3	81	220 V
4	82	220 V
5	80	220 V
6	53	Magnetron current
7	84	220 V

Terminal block 1199		
1	87	Contactor winding
2	88	220 V
3	79	Interlock
4	89	Interlock
5		
6		
7		

Connector 1131		
1	95	220 V
2		
3	94	220 V
4		

Connectors: 1036; 1037, 1038; 1039; 1130		
1	3	I.F.A. PK-47
1	4	A.F.C. mixer PK-47
1	1	Output of receiver PK-31
1	2	Heterodyne PK-47
1	5	800 V – ПВ-ЛЭ-2

Connector 3001

Pin No.	Wire No.	Circuit
1	93	~220 V
2	95	

Connector 3005

Pin No.	Wire No.	Circuit
1	1	+30 V anode I; anode II
2	2	+300 V anode I; anode II
3	3	~2.5 V filament
4	4	+10 V beam-forming electrode
5	5	-150 V cathode
6	6	-200 V solenoid
7	7	+200 V
8	8	+450 V Commutator

Connector 3003

Pin No.	Wire No.	Circuit
1	5	+200 V
3	7	-200 V
4	176	~220 V phase "B"

Type of cabinet	Diagram No.
E	EA2.000.062. схэ
Д	EA2. 000. 063 схэ
B	EA2. 000. 064 схэ
Г	EA2. 000. 065 схэ
A	EA2. 000. 066 схэ

Specifications to Key Diagram of H.F. Units ША-50

Ref.Nos on diagram	Description	Type or designation	Notes
1	Magnetron	МИ-22, МИ-24, МИ-25, МИ-26, МИ-89	
2	Neon lamp	МН-3	
3	Miniature valve	2.5 V, 0.075	
4	Milliammeter, 50 mA	M-41	
6	Protective thermal relay		
7	Resistor	ВС-60-51 ohms ±20%	
8	Same	ВС-1.0 20 kilohms±10%	
9	Same	ВС-2.0-1 kilohms±10%	
10	Same	ВС-0.25-33 kilohms±10%	
11	Same	ВС-5-5.1±10%	
13	Same	Wire-wound 500 W - 100 ohms	
14	Capacitor	КБГ-М1 400-0.25-III	
15	Same	КБГ-МН-2в-600-1/Н-II	
16	Same	КБГ-МН-2в-600-1/Н-III	
17	Same	8кв, 2.2; 42кв 0.002 III	Permissible 0.0022
18	Same	КБГ-МН-2в-400-1/Н-III	
19	Same	КСО-5 500-А-6.8 kilohms II	
22	Filter choke	2.5 to 3 mH	
24	Pulse transformer		
25	Heater transformer		
26	Wire-wound resistor		
27	Magnetron fan		
28	Receiver fan		
29	Centrifugal relay	ЦР-1	
32	Protective spark discharger		
33	Interlock contacts		
34	Circuit-breaker	АЛ3х5с/3	
36	Safety fuse, 0.25 A, 1-47	ПК	
37	Two-pole tumbler switch		
38	Permanent magnets	МР-Б	
39	Waveguide-to-magnetron coupling	СМ-А,В,Г,Д,Е	
40	Waveguide section with louver		
42	Firing rectifier	ЯП-01	
41	Echo-pulse receiver	ЕЭ-02	
43	Receiver supply unit	БК-01	
45	Antenna switch	АП-А,В,Г,Д,Е	
46	Amplifier employing travelling-wave valve	МВ-50	
47	Amplifier control and supply unit employing travelling-wave valve	БП-140	

Specifications to Key Diagram of Unit of Central Control
Panel ШУ-02

Ref.Nos on diagram	Description	Type or designation	Notes
1	2	3	4
1	Voltmeter, 250 V	Э-30	Ready-made
2	Milliammeter	М-41,0-50 mA	Same
3	Same	Same	Same
4	Same	Same	Same
5	Same	Same	Same
6	Same	Same	Same
7	Neon lamp	МН-3	
8	Same	Same	
9	Same	Same	
10	Same	Same	
11	Same	Same	
12	Same	Same	
15	Resistor	ВС-1,0-20 kilohms 10%	
16	Same	Same	
17	Same	Same	
18	Same	Same	
19	Same	Same	
20	Same	Same	
23	Same	ВС-2-1 kilohms 10%	
24	Same	Same	
25	Same	Same	
26	Same	Same	
27	Same	Same	
30	Capacitor	КБГ-МН-2в-400-1-III	
31	Same	Same	
32	Same	Same	
33	Same	Same	
34	Same	Same	
37	Same	КСО-5-250-А-10,000-II	
38	Same	Same	
39	Same	Same	
40	Same	Same	
41	Same	Same	
44	H.F. choke	2.9 mH	
45	Same	Same	
46	Same	Same	
47	Same	Same	
48	Same	Same	
51	Illumination transformer	220/12 V	
52	Pressed socket		
54	Switch (modification)		

1	2	3	4
55	Voltmeter switch		
57	Two-pole tumbler switch		
58	Same		
59	Safety fuse ПК		
60	Same	1=47 mm 3 A	
61	Same	1=47 mm 2 A	
62	Same	1=47 mm 3 A	
63	Same	1=47 mm 3 A	
64	Starting push-button	1=47 mm 3 A	
65	Resistor		
66	Same	BC-1-10 kilohms 10%	
67	Same	Same	
68	Same	Same	
69	Same	Same	
70	Same	Same	
71	Miniature valve MH-16	Same	
72	Same	13.58 0.18 A	
73	Same	Same	
		Same	

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50X1-HUM

Specifications to Key Diagram of Unit ШУ-50

Ref.Nos on diagram	Description	Type or designation	Notes
1	2	3	4
1	Neon lamp	МН-3	
2	Same	Same	
3	Same	Same	
4	Same	Same	
5	Same	Same	
6	Same	Same	
7	Voltmeter, 0-250 V	Э-30	
9	Remotely controlled circuit-breaker	АД3x15с/3	
12	Relay	РА-4п	
13	Remotely controlled circuit-breaker	АД-3x15б/3	
14	Same	АД-3x15с/3	Type I
15	Same	Same	Type I
16	Same	АД-3x35с/3	Type I
17	Motor-type time relay	МРВ-150-1п-3в	Setting IV
18	Same	МРВ-150-1п-3в	Setting IV
19	Five-section switch		
20	Two-section switch		
21	Two-pole tumbler switch		
22	Five-section switch		
23	Four-pole switch		
24	Pressed socket		2 pieces
25	Same		2 pieces
26	Two-pole tumbler switch		
27	Same		
28	Warning signal button		
29	Remotely controlled circuit-breaker	АД-3x35б/3	
30	Same	АД-3x35б/3	
31	Illumination transformer		
32	Magnetron heater autotransformer		
33	Safety fuse, 3 A	ПК-3А	
34	Safety fuse, 3 A	ПК-3А	
35	Safety fuse, 5 A	ПК-5А	
37	Safety fuse, 0.5 A	ПК-0.5А	
41	Resistor	ВС-1.0-20 kilohms±10%	
42	Same	Same	
43	Same	Same	
44	Same	Same	
45	Same	Same	
46	Same	Same	
47a	Trimming choke		
47b	Same		
49	Pressed socket		2 pieces
50	Same		Same

1	2	3	4
51	Pressed socket		2 pieces
52	Same		Same
53	Same		Same
54	Switch		
58	Adjusting resistor, 12 - 14 ohms		
59	Adjusting resistor, 12 - 14 ohms		
61	Pan		
62	One-point receptacle		
63	One-point receptacle		
64	Capacitor	КСО-В-2500-А-1000-III	
68	Relay	РА-4П	
69	Resistor	ВС-1.0-15 kilohms±10%	
70	Same	ВС-1.0-6.8 kilohms±10%	
71	Same	ВС-1.0-30 kilohms±10%	
72	Same	Same	
73	Same	Same	
74	Same	Same	
79	Safety fuse, 5 A	ПК-5А	
80	Same	Same	
81	Safety fuse, 1 A	ПК-1А	
82	Safety fuse, 10 A	ПВ-10А	
83	Safety fuse, 10 A	ПВ-10А	
84	Selsyn supply transformer		
85	Same		
86	Remotely controlled circuit-breaker	АД-3х35о/3	Type III
87	Same	АД-3х35б/3	
1179	Terminals		3 pieces
1180	Distribution bus-bars		3 pieces
1181	12-contact adapter		
1182	Same		
1183	Same		
1184	Same		
1185	Same		
1186	Same		
1187	Same		
1188	Same		
1190	Same		
1191	Same		
1192	Same		
1193	Same		
1194	9-contact adapter		
1195	Same		

Notes
4
с/3
5б/3
5с/3 Type I
Type I
5с/3 Type I
0-1п-3в Setting IV
0-1п-3в Setting IV
2 pieces
2 pieces
35б/3
35б/3
0А
lohms±10%
2 pieces
Same

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50X1-HUM

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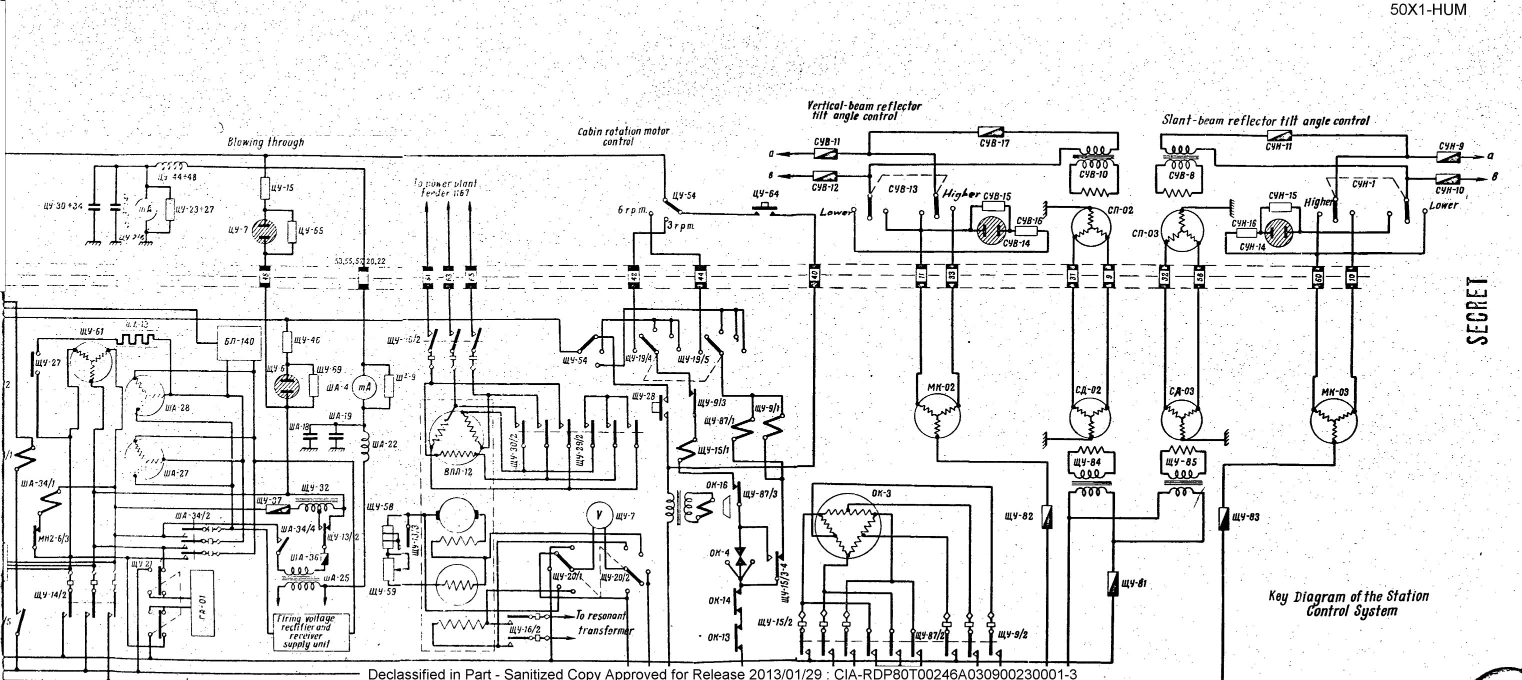

Key Diagram of the Station Control System

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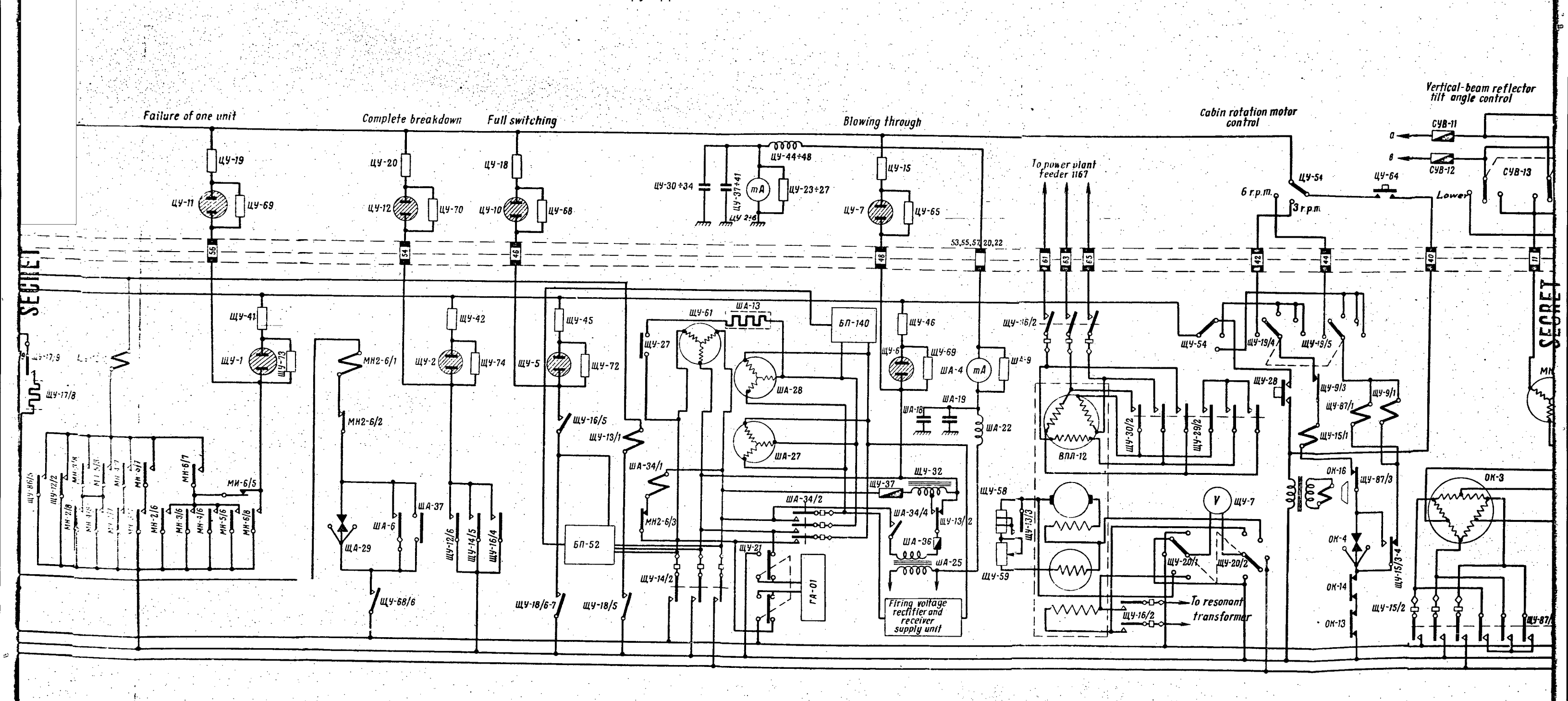

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Failure of one unit
Complete breakdown
Full switching
Blowing through
To power plant feeder 1167
Cabin rotation motor control
6 r.p.m.
3 r.p.m.
Vertical-beam reflector tilt angle control
Lower
Firing voltage rectifier and receiver supply unit
To resonant transformer
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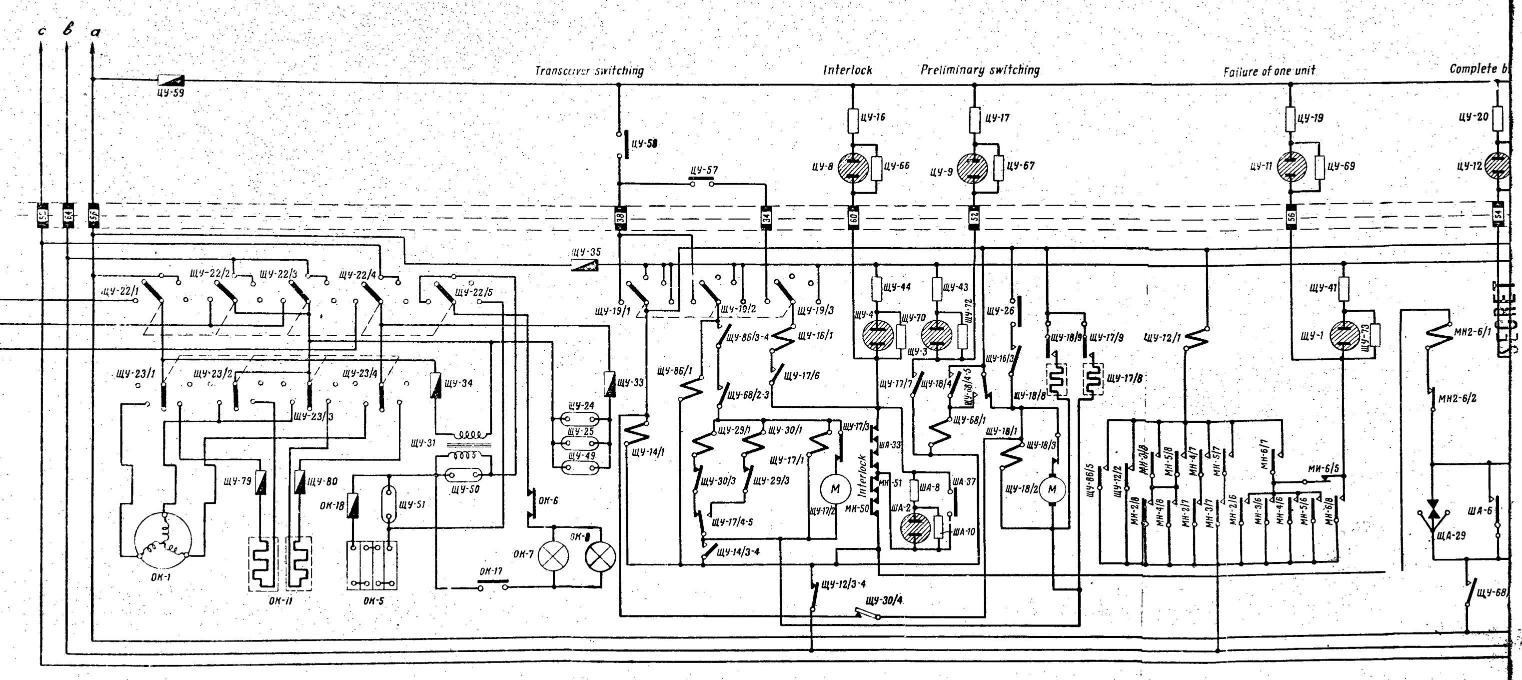
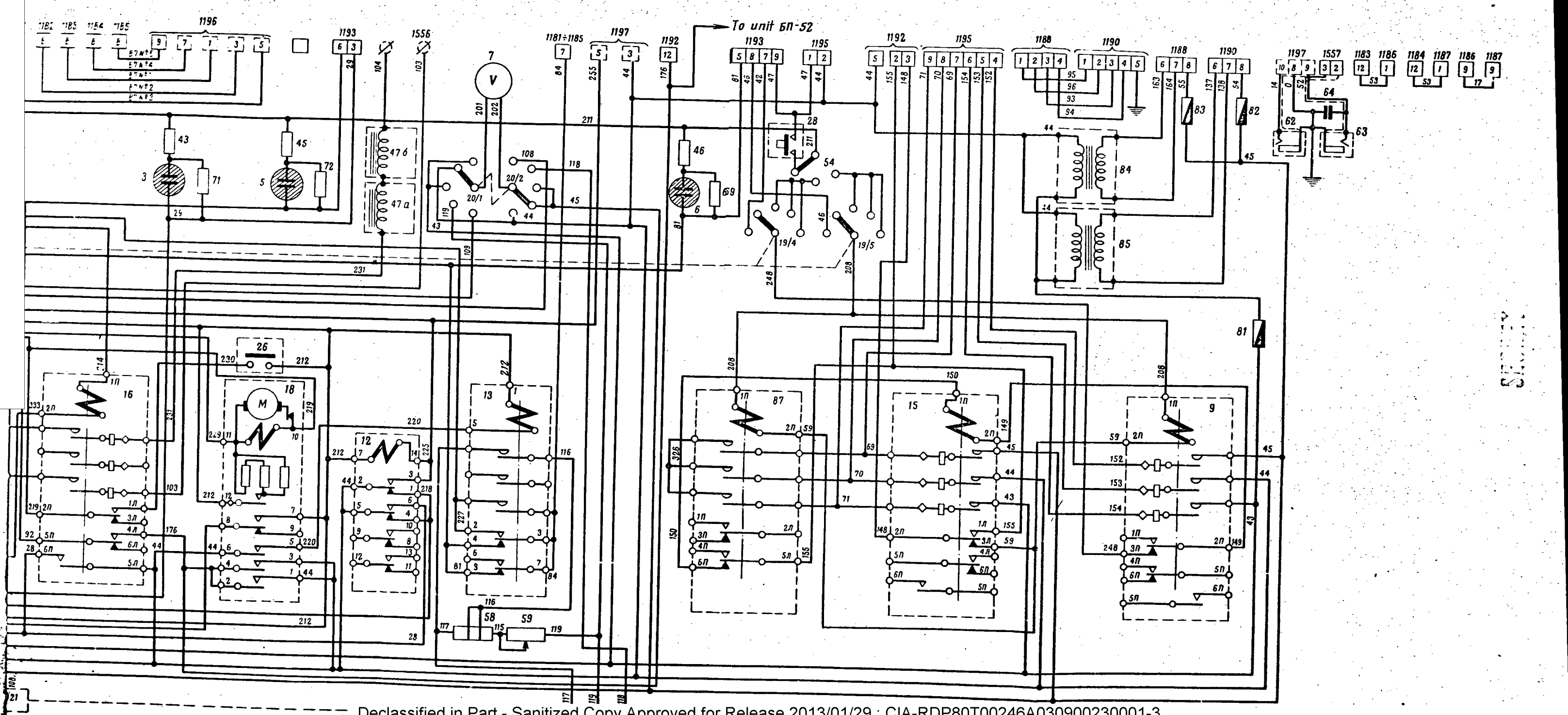
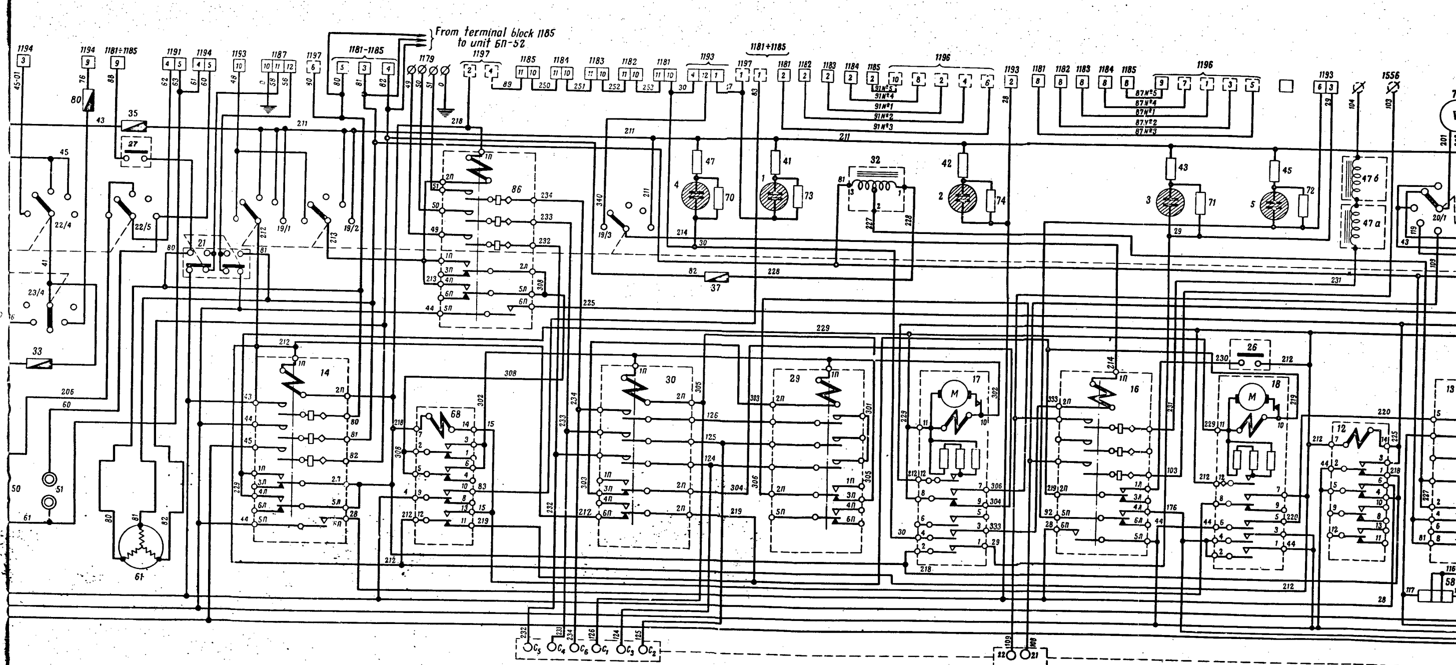
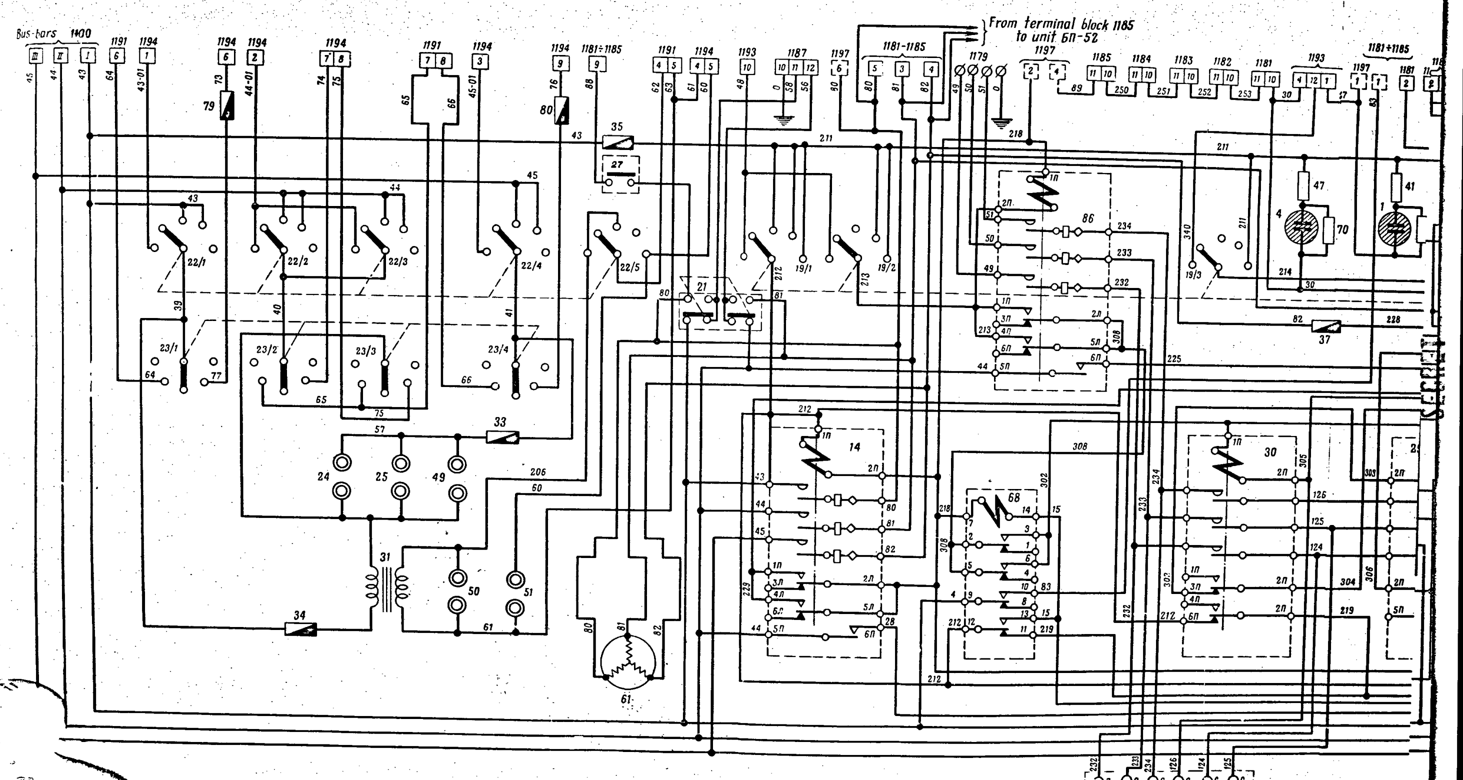

c
в
a
Transceiver switching
Interlock
Preliminary switching
Failure of one unit
Complete b
External supply
ЩУ-59
ЩУ-58
ЩУ-57
ЩУ-16
ЩУ-8
ЩУ-66
ЩУ-17
ЩУ-9
ЩУ-67
ЩУ-19
ЩУ-11
ЩУ-69
ЩУ-20
ЩУ-12
ЩУ-35
ЩУ-22/1
ЩУ-22/2
ЩУ-22/3
ЩУ-22/4
ЩУ-22/5
ЩУ-23/1
ЩУ-23/2
ЩУ-23/3
ЩУ-23/4
ЩУ-34
ЩУ-33
ЩУ-31
ЩУ-79
ЩУ-80
ЩУ-51
ЩУ-50
ЩУ-24
ЩУ-25
ЩУ-49
ЩУ-19/1
ЩУ-19/2
ЩУ-19/3
ЩУ-14/1
ЩУ-86/1
ЩУ-16/1
ЩУ-17/6
ЩУ-29/1
ЩУ-30/1
ЩУ-17/1
ЩУ-30/3
ЩУ-29/3
ЩУ-17/4-5
ЩУ-14/3-4
ЩУ-12/3-4
ЩУ-30/4
ЩУ-44
ЩУ-43
ЩУ-4
ЩУ-70
ЩУ-3
ЩУ-72
ЩУ-26
ЩУ-16/3
ЩУ-18/8
ЩУ-18/1
ЩУ-18/3
ЩУ-18/2
ЩУ-68/1
ЩУ-17/7
ЩУ-17/8
ЩУ-17/9
ЩУ-12/1
ЩУ-41
ЩУ-1
ЩУ-73
ЩУ-86/5
ЩУ-12/2
ЩУ-68
Interlock
МН-50
МН-51
ША-33
ША-8
ША-37
ША-2
ША-10
ША-6
ША-29
МН2-6/1
МН2-6/2
МН-6/5
МН-6/7
МН-2/8
МН-3/8
МН-4/8
МН-5/8
МН-2/7
МН-3/7
МН-4/7
МН-5/7
МН-2/6
МН-3/6
МН-4/6
МН-5/6
МН-6/8
ОК-1
ОК-11
ОК-5
ОК-6
ОК-7
ОК-8
ОК-17
ОК-18
M


To unit БП-52


From terminal block 1185
to unit 6П-52


From terminal block 1185
to unit 6П-52
Bus-bars 1100

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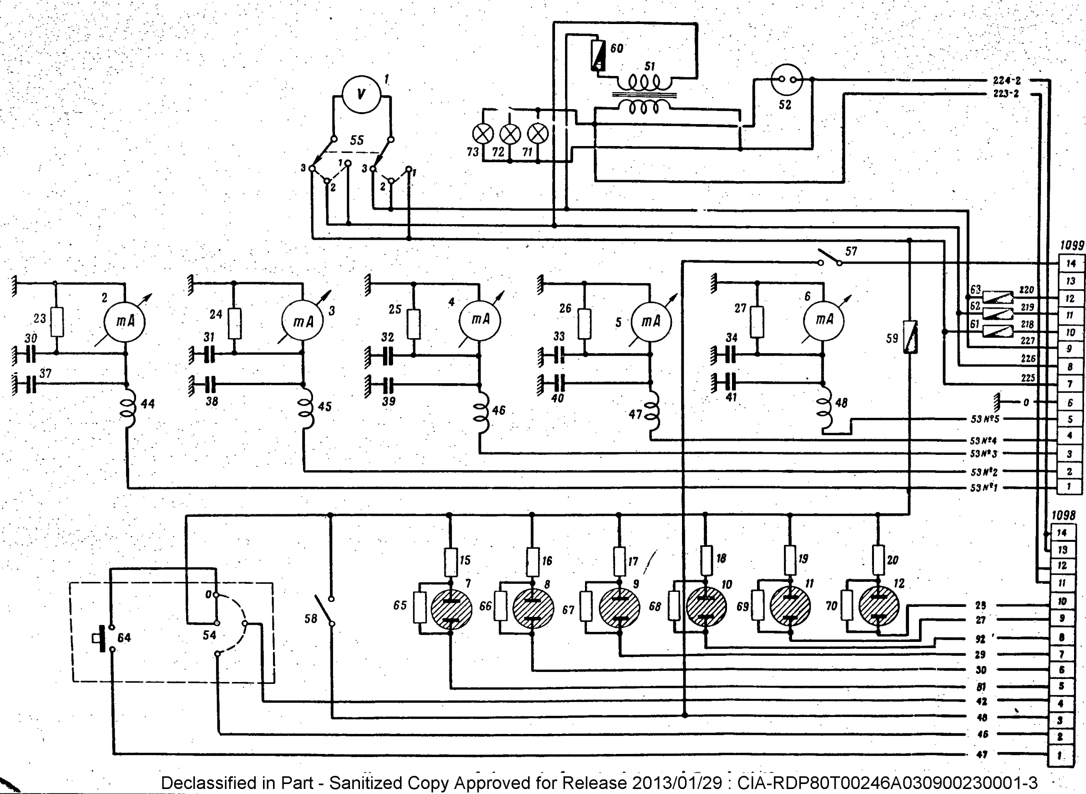

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		Connector 1099	
Pin No.	Wire No.	Circuit	
1	53 No.1		
2	53 No 2		
3	53 No 3	Magnetron current measurement	
4	53 No 4		
5	53 No 5		
6	0	Earth	
7	225		Phase a
8	226		Phase b
9	227	Suply mains,	Phase c
10	218	220 V.	Phase a
11	219	50 c.p.s	Phase b
12	220		Phase c
13	–		
14	340	High voltage	

		Connector 1098
Pin No.	Wire No.	Circuit
1	47	Rotation on warning signal
2	46	Cabin rotation motor 6 r.p.m. on
3	48	Full switching of station
4	42	Cabin rotation motor 3 r.p.m. on
5	81	Waveguide blowing-through
6	30	Interlock
7	29	Preliminary switching
8	92	Full switching
9	27	Failure of one unit
10	28	Complete breakdown
11	-	
12	-	Instrument illumination, 12 V, 50 c.p.s.
13	-	
14	-	